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Flight Surgeon Support to United States Air Force Fliers in Combat

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May 2003

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The everyday practice and operational applications of U.S. Air Force flight medicine by its flight surgeons at the end of the 20th century comprise a system of medical care and support that is unique in human history. This system of preventive, occupational, clinical and participatory medicine seems so natural that modern aviators and flight surgeons may take it for granted, having little understanding of the manner in which it developed and matured. Yet, one may fairly argue that military aviation as we know it today would not be possible without its flight surgeons. Herein lies an in-depth review and analysis of the role of the flight surgeon in combat operations from an academic and historical point of view. This report provides a rich source of information both for novice flight surgeons and for their experienced colleagues, as well as a historical record, a detailed bibliography and a summary of the lessons hard-learned in past conflicts. Examples of the consequences of not providing aeromedical services provide a clear justification for the existence of the flight surgeon system and may prove useful in times of cutbacks in personnel and funding. The record clearly demonstrates that physicians trained in the principles of aviation medicine and assigned to flying units to care for the fliers contribute in specific ways to unit safety and effectiveness. Acknowledging the significant and notable contributions to flight medicine made by our aeromedical colleagues in the Navy and in the post-1949 Army, this report focuses on Army flight medicine prior to 1949 and Air Force flight medicine subsequent to 1949.

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FOREWORD

On the eve of the celebration of the centennial of powered flight in December 2003, and the 75th anniversary of the Aerospace Medical Association in October 2004, the distinguished authors of this study have presented the aerospace medical community an excellent contribution – a much-needed history of U.S. Air Force flight surgeon support to combat operations. Peacetime aviation medicine and space medicine are also vital components of aerospace medicine, but there is no question that many of their most important principles and practices derive from medical experiences in wartime aerial combat.

This history of medical support to U.S. Air Force combat operations fills a long-standing gap in our medical and historical literature. Not since Douglas H. Robinson, M.D., published *The Dangerous Sky: A History of Aerospace Medicine* in 1973 has there appeared such a well-researched and wide-ranging survey. Robinson described in detail the early years of aviation medicine, especially in the United States. Between World War I and the end of World War II, the U.S. Navy and U.S. Army Air Forces established their flight surgeon programs. The Army Air Force flight surgeons soon received a new organizational home in the Air Force Medical Service that was established in July 1949.

Over the next fifty-four years, the U.S. Air Force engaged in a series of smaller but still noteworthy combat events – the Korean War, the Vietnam War, and operations in Grenada, Libya, Panama, the Persian Gulf War, the Balkans, Afghanistan, and most recently the liberation of Iraq. During these years, the Air Force Medical Service continued to improve its combat support in many new ways that now warrant a fresh historical survey. Air Force combat operations have encountered the extremes of global geography, supersonic speed, and high altitude. As the Air Force transforms itself into a globally engaged air expeditionary force, medical support to these operations demands the very best of the aviation medical community.

Looking beyond Douglas Robinson's history, which concluded with the early jet age in the 1950s, the present authors – Col. David R. Jones, USAF, MC, CFS, Ret., and Col. Royden W. Marsh, USAF, MC, FS, Ret. – have carried the story ahead to our flight surgeon support through the Air War over Serbia in 1999. There are lessons here for every echelon.

With their substantial personal experience in flight medicine, clinical practice, and scholarship, these two authors offer not only a historical narrative but also a valuable summary, from their perspective, of the most important lessons of the historical events they describe. One of their most notable observations focuses on the needs of their clients and patients: "In order to maintain and prolong aircrew combat effectiveness, fliers require a degree of command sensitivity, personal aeromedical support and mental hygiene different from that required by other combat personnel."

With the ongoing support of the School of Aerospace Medicine, this book should help make that observation an accepted fact among all our Air Force flight surgeons and their Line colleagues.

Lieutenant General George Peach Taylor, Jr.
Surgeon General, United States Air Force
25 April 2003

PREFACE

The physician must know what his predecessors have known if he does not wish to deceive himself and others.
(Hippocrates, quoted in U.S. Armed Forces Med J. 1952; 1:1.)

The study of history is mankind's warning to itself.
(Yevgeny Yevtushenko, "The Wild Berries." 1989. New York: Henry Holt, p. 125.)

The everyday practice and operational applications of U.S. Air Force flight medicine by its flight surgeons at the end of the 20th century comprise a system of medical care and support that is unique in human history. Today this system of preventive, occupational, clinical and participatory medicine seems so natural that modern aviators and flight surgeons may take it for granted, having little understanding of the manner in which it developed and matured. Yet, one may fairly argue that military aviation as we know it today would not be possible without its flight surgeons. The authors wish to gather under one cover the broad sweep of development of the flight surgeon system and, at the same time, to acknowledge some of the individual flight surgeons, our predecessors, who lived the story one day at a time. Why write a history of Air Force flight surgeons in combat operations? The first century of aerospace medicine is ending, and the time seems right.

Although a great deal of material exists about the subject of this Technical Report, no one has attempted an in-depth review and analysis of the role of the flight surgeon in the United States Air Force (USAF) combat operations from the academic and historical points of view. Properly done, such a review might provide a rich source of information both for novice flight surgeons and for their experienced colleagues. A scholarly approach to the subject has further value in its own right in creating a historical record. A detailed bibliography, in addition to its value as a key to documentation, would ease any interested reader's access to the rich literature on the subject, much of which has become obscure with the passage of time.

Beyond these scholarly motivations, one quickly perceives that the lessons hard-learned in past conflicts—and sometimes forgotten and relearned—are of use in current operations and quite probably will remain so in any future situation where flight surgeons must support USAF fliers in times of crisis. Every war is different, but some aspects seem never to change. Examples of the consequences of not providing aeromedical services provide a clear justification for the existence of the flight surgeon system. Such examples—succinct "lessons learned"—may prove useful in times of cutbacks in personnel and funding.

What is unique about Air Force flight medicine? Its practitioners, the flight surgeons, practice an art that includes, but transcends, the age-old art of therapeutic clinical medicine. Flight surgeons diagnose and treat illness, the traditional role of physicians. They also examine and identify among individuals who wish to fly those who are physically and mentally fit to fly. Once the Air Force has trained these candidates and qualified them as aviators, the flight

surgeons must assist in maintaining their fitness, affirmed by continual informal surveillance and periodic formal certification. As we will see, this affirmation of fitness goes far beyond simply having fliers who are "healthy," since not all healthy people are fit or motivated to fly. Fitness to fly in the Air Force includes, for example, being trustworthy to control hugely efficient and deadly war machines. Today's combat and combat support aircraft demand the utmost in physical mastery in unforgiving circumstances, plus the skill, judgment and insight to be trusted with weapons of mass destruction never experienced by the human race. Just as maintenance personnel keep aircraft fit to fly and fight, so flight surgeons, like athletic trainers on a championship team, keep their aviators in top shape for action.

Military flight medicine involves another unique element: risk to its practitioners. Consider the ordinary stressors of anyone's life. Add the stressors of aviation. To these, add the special rigors of military aviation. Now add the stressors of deployment. Finally, add the stressors of flying combat or combat support missions, with their intrinsic possibilities of sudden death for self or others. These stressors comprise an unfortunate but undeniable element of an aviator's war. Military flight surgeons, unlike civilian Aviation Medical Examiners, are required to meet approximately the same physical and mental standards as their fliers, and to enter the professional arena of aircrew members by participating with them "in regular and frequent aerial flight." These dry words have remained unchanged since they appeared in 1912 as part of the first U.S. Army regulation establishing formal flying status. As surely as the fliers place their lives and careers in the hands of the flight surgeons in the arena of medicine, so the flight surgeons place their lives in the hands of the fliers with whom they take to the sky. The designation of "flight surgeon" came into being in 1917. Little more than a year later came the first death of a flight surgeon in the performance of his duties when Major William Ream died in a mishap. Since then, ninety-one flight surgeons have died in aircraft with their aircrew: thirteen in combat and the rest in mishaps, either in declared wars, the Cold War, or in peacetime training and familiarization flights. No other medical specialty—and aerospace medicine became a recognized medical specialty fifty years ago—presents such a risk to its practitioners.

Military flight medicine demands knowledge of the disciplines of medicine, the military, and aviation. The mission of flight surgeons who support combat operational units is to keep their fliers safe, healthy and effective so that they can fly, fight and win. In this Technical Report, one will find documentation and explicit examples of such support. The record clearly demonstrates that physicians trained in the principles of aviation medicine and assigned to flying units to care for the fliers can contribute in specific ways to unit safety and effectiveness. Improvement in safety and effectiveness can be measured by objective changes in unit statistics, which are cited in this Report when available. These results have been corroborated by the contemporary judgment of responsible line officers at all levels of command since September, 1918, when the first flight surgeons joined flying units of the American Expeditionary Force in Europe.

Several specific military aeromedical principles have evolved. History demonstrates that aeromedical authorities should obtain the support of line commanders within the chain of command, train competent and motivated volunteer medical officers to be flight surgeons, and assign them to specific operational flying units at the squadron level as their primary duty. Line commanders should billet flight surgeons with their fliers, give command support to the

necessary aeromedical decisions that assure operational safety and effectiveness, and use periodic *rest* as a powerful counter to flying fatigue in combat situations. Flight surgeons should be active in the unit environment, provide necessary preventive and therapeutic medical care, fly with their fliers in the operational environment to assure mutual familiarity with the immediate flying milieu, and share the experiences that encourage unit cohesion.

In traditional terms, military forces in any combat situation attempt to break the enemy's will to resist, to demoralize the foe in order to win. In medical terms, this is an effort to induce stress-related symptoms in an opponent who is attempting to cause these same symptoms in our troops. Operational flight surgeons support their fliers by supporting and strengthening their health, hardiness, resilience, will to carry on and resistance to the stressors of combat flying. Such medical efforts, once termed "mental hygiene," are now considered a part of military preventive medicine.

This review begins with the origins of military aviation in the U.S. Army after 1907 and its first combat applications in the Mexican border conflicts. We will trace the development of the flight surgeon concept in 1917, and the work of the world's first designated and trained flight surgeons in the Great War of 1917-1918. Proceeding through the years between the world wars and through World War II, we will discuss the drawdown of the U.S. Army Air Forces in the postwar years, the Berlin Airlift and the beginning of the Cold War in the late 1940s, a contest that lasted until the late 1980s. We will review the establishment of a separate U.S. Air Force in 1947 and the formation of the USAF Medical Service two years later.

The new USAF began its combat history with the Korean War (1950-1953), followed less than a decade later by the thirteen-year conflict in Vietnam War (1960-1973). As the Cold War ended with the fall of the Berlin Wall and the dissolution of the Soviet Union, the U.S entered an era of asymmetrical warfare, carrying out operations in Grenada, Libya, and Panama in the 1980s. These were followed by more extended conflicts in the Persian Gulf area in 1991 and in Serbia in 1999. While this review was being written (1999-2003), the era of asymmetrical warfare expanded to include the international war on terrorism.

American airpower progressed during the 20th century, and aviation medicine grew into aerospace medicine. The operational and combat applications of military flight medicine developed as well. Although colleagues in the Navy and in the Army since 1949 have made significant and notable contributions to flight medicine, this report does not review either the combat experiences of U.S. Naval flight surgeons or those of U.S. Army flight surgeons after 1949. However, we will touch on some of their individual accomplishments.

We propose the hypothesis that the professional services provided by flight surgeons have a measurable and beneficial effect upon the safety, health and effectiveness of flying units in time of war. The success of aeromedical efforts may be measured indirectly in several ways: by changes in accident rates, by mission effectiveness, by days lost from flying duties for various causes, or by assessments of morale (itself a difficult task). Because non-medical factors (enemy action, weather, maintenance) certainly affect these factors, one may not easily achieve a clear determination of the effectiveness of aeromedical programs.

At the end of this review, we will summarize the lessons learned from these conflicts. We will also comment upon the applications of these lessons to some of the aeromedical concerns that may arise in future conflicts.

David R. Jones
Royden W. Marsh
12 December 2003

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Finally, we salute all men and women of the United States Air Force, past and present, and especially the fliers and flight surgeons, our colleagues. This report is dedicated to their accomplishments, and to their devotion to their country and their duty.

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CHAPTER 1

1907-1941: ORIGIN OF U.S. ARMY MILITARY AVIATION UNTIL U.S. ENTRY INTO WORLD WAR II

I consider it an honor to have been one of the first generation of Military Aviators who were then, like the Wright brothers, considered as fit inmates for insane asylums... (Foulois,1955)

1907 to 1917: Early Military Aviation Medicine

Medical officers have been involved with military aviation from its earliest roots. In 1819, U.S. Army Surgeon General Joseph Lovell ordered military physicians to maintain records of weather, temperature and precipitation at their stations for epidemiologic purposes.[1] Brig. Gen Albert J. Myer, a military physician for whom Fort Myer, Virginia is named, became the Army's Chief Signal Officer in 1860. Ten years later, he transferred the Medical Department's weather reporting responsibilities into his command. The Army subsequently designated this organization as a separate Signal Corps in 1881 (Meiling, 1984). Even though the U.S. Army had used observation balloons extensively in the Civil War, usually under local commanders, the Signal Corps only operated one between that conflict and the Spanish American War. In 1892, Signal Corps troops honored their former commander by naming that balloon the "General Myer" (Glines, 1980, p. 39). Ballooning interested President Theodore Roosevelt himself, since balloon reconnaissance had furnished valuable intelligence to him during the Cuban campaign of the Spanish-American War. Spanish rifle fire finally brought down the "General Myer" at the Battle of San Juan Hill (Freidel, 1962). Subsequent Army balloon activities, including the Bennett Trophy races, led to Roosevelt's presidential memorandum of 1 August 1907 granting to the Signal Corps "charge of all matters pertaining to military ballooning, air machines, and all kindred subjects" (Glines, 1980, pp. 38-43).

The "kindred subjects" soon included airplanes. The Wright brothers had made their initial flights in 1903. The U.S. Army purchased its first military airplane in 1907 and assigned it to the Signal Corps' newly-organized Aeronautical Division, thus retaining aviation in General Myer's original command. At first there was no question of any specific physical qualification for aviators; flying was simply another form of military service. The opinion of the instructor pilot was the "gate" then, one that still remains the ultimate means of pilot selection. During the early days of Army aviation, each aircraft was acquired and flown singly. Any medical support required (usually after a crash) came from local base hospital units. The first dedicated aeromedical support began with the founding of a flying school at

[1] In 1833, William Beaumont dedicated his book, Experiments and Observations on the Gastric Juice, and the Physiology of Digestion, to Surgeon General Lovell, "whose zeal in the cause of Medical Science is equaled only by his ability to promote it."

College Park, Maryland in 1911. Charles deForest Chandler, a pioneer military aviator and the school's first commander, wrote in his memoirs:

"[M]edical service was provided by assigning as the surgeon of the station First Lieutenant John P. Kelley, Medical Reserve Corps, United States Army. He became the first Medical Officer specially assigned to a flying school in this country and may therefore be credited as the first "Flight Surgeon." Lieutenant Kelley remained with the aviation school until the autumn of 1912, always most conscientious in being present during flying training and in attending the injured skillfully and promptly after every crash" (Chandler & Lahm, 1943, pp. 196-7).

John F. Fulton, in his preface to Benford's history of aviation medicine, also mentions Lt. John P. Kelly [sic], a Medical Reserve officer assigned in 1911 to the nation's only flying school, located at College Park, Maryland, for a two-year tour of duty (Benford, 1955, p. ix). Kelley deployed with the College Park fliers and their aircraft to winter quarters in Augusta, Georgia during the winter of 1911-12 (Chandler & Lahm, 1943, p. 211). Little has been written of Kelley's duties, or whether he himself ever flew. This would have been possible, since several of the five College Park aircraft could carry a passenger as well as the pilot. A contemporary newspaper account states that 1/Lt. Henry Arnold carried Captain Williams, an army medical officer, on a fifteen-minute "hydroaeroplane" flight at a field near the War College in Washington on 28 September 1912 (Washington Post, 1912b).

Kelley helped recover the bodies of Lieutenants L. W. Hazlehurst (frequently spelled "Hazelhurst") and civilian instructor Arthur L. ("Al") Welsh in a crash at College Park on 11 June 1912. In a later crash at the same location on 28 September 1912, Kelley aided in recovering of the body of passenger Corporal Frank S. Scott and rescuing the badly injured pilot Lt. Lewis C. Rockwell, who later died in Walter Reed Army Hospital, (Hennessy, p. 232; Washington Post, 1912a and 1912b; Benford, 1955, p. ix). General Henry H. ("Hap") Arnold described Kelley, whom he knew at College Park "from 1911 to 1913" [sic] as "a first-rate flight surgeon" (Arnold, cited in Link & Coleman, 1955, p. 20). Although the term "flight surgeon" was not coined until 1917, Arnold, Chandler and Lahm were among the earliest Army aviators, and their use of these words to refer to an Army physician serving in 1911 may have been based on its common use at the times they were writing (1943 and 1944, respectively). Terminology aside, these reports attest to their perceptions of explicit and dedicated aeromedical support in 1911.

Experience quickly demonstrated that not everyone wanted to fly, and that not all of those who wanted to fly were able to do so. Flying required more than general physical health; things could go wrong in a pilot that would not disqualify him from general military duty, but could make him inefficient, ineffective or unsafe in the air. A degree of illness or ineffectiveness that might not significantly degrade a person's performance as an infantryman or tank driver could result in the crash of an aircraft with loss of a valuable military commodity, and perhaps of aircrew life. The German Air Force established special physical examinations for its fliers as early as 1910, and the French did the same in 1917 (Armstrong, 1943, p. 8; Grow, 1918; Gunga & Kirsch, 1995). According to some authorities, on 2 February 1912 a few aviation-oriented military physicians in the Office of the Surgeon General of the U.S. Army drew up specifications for a special physical examination for aviators "with the aid of a textbook of physiology" (Armstrong, 1943, p. 10;

Beaven, 1939; Meiling, 1984). Wilmer, citing notes from a retired Col. William Lyster [*sic*; not otherwise identified], dates these specifications to 22 July 1914. In Lyster's words:

> The results were a little surprising. After a month or six weeks, Col. Reber [Col. Samuel Reber, Chief of the Aviation Section of the Signal Corps] appeared again [in the office of the Surgeon General of the Army]. He announced that these standards were so high that no applicant had been able to pass the examinations, and he expressed a desire to have the regulations lowered to enable the Aviation Section to obtain personnel. This was done. As far as could be determined, the civilian aviators then in the public eye had never been examined physically (William Lyster, cited in Wilmer, 1935).

No medical involvement in aviation beyond such entry physical standards existed in any nation's air force when the Great War began in 1914, except that "a service for the medical control of aviators [otherwise undefined] functioned regularly in Germany" (Armstrong, 1943, p. 8). The lack of formal aviation medical programs in the Allied air forces of that era allows an opportunity for examination of the safety and efficiency of flying units in combat before and after the establishment of such programs during this era.

> As for the 'care of the flyer,' that this required the services of a specially trained medical officer was not apparent to the military leaders of the European air forces, and the flight surgeon as we know him today did not appear until late in the war. The resulting wastage of trained manpower was enormous, not only in terms of men killed at the Front or in training, but also in men who were 'flown out' or 'stale' from months of continuous combat duty without interruption, who might have...continued in flying status with appropriate rest leave advised on medical grounds (Robinson, 1973, p. 88).

1913 to 1916: U.S. Army Aviation Operations Along the Mexican Border

Incursions of Mexican paramilitary units, rebels and bandits across the U.S.-Mexican border during periods of unrest and revolution presented a continuing problem in the early years of the century. The Army deployed an aerial detachment of five College Park aviators, provisionally designated as the First Aero Squadron, from their winter quarters in Augusta, Georgia to Fort Crockett near Texas City, Texas in March of 1913 in support of Second Army Division maneuvers (Hennessy, 1985, pp. 76ff). These pilots flew several reconnaissance missions along the border during the Huerta coup d'etat against the Carranza regime in Mexico. Some documents mention that Dr. Kelley accompanied this deployment (Hennessy, 1985, p. 47), while others indicate that he was relieved from active duty with the Army at College Park in September of 1912 (Chandler & Lahm, 1939, p. 197). No mention is made of him in reports of flying operations in Texas, and Army medical support to this mission probably came from the hospital and ambulance units of the Second Division.[2]

The First Aero Squadron remained with the Second Division at Texas City until November 1913. As hostilities subsided, most of the unit transferred to the new Signal Corps Aviation School being formed at North Island Field in San Diego, California, leaving three pilots at Texas City. One of these was disabled in a motorcycle accident on 30 June. A second, Lt. Loren H. Call, was killed in a plane crash on 8 July. The third, 1/Lt. Roy L. Kirtland, remained alone because the only three aviators available to augment his services were

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[2] Although U.S. forces had no part in the action, the first war bombing in the Western hemisphere took place during this period. On 10 May 1913, two American nationals flying in revolutionist General Pancho Villa's Curtiss-type pusher bombed a Mexican gunboat in Guaymas Bay (Hennessy, 1985, p. 78).

conducting the flying training program at North Island. Kirtland finally went to North Island, the site of Glenn Curtiss's flying school, in November 1913. This ended flying operations at Texas City (Hennessy, 1985, p. 79).

The first military operations directly involving the use of U.S. aircraft against a military force were those of the U.S. Navy against Mexican forces in Vera Cruz the following year (Robinson, 1973, p. 59). The USS Mississippi carried several Curtiss AB flying boats to the Vera Cruz harbor in April 1914, and Lt. (j.g.) P.N.L. Bellinger flew a mission to search for mines on 25 April in an AB-3 aircraft. Presumably the medical support for the fliers involved came from the ship's medical department (Taylor, 1974).

During this second Mexican crisis, a detachment of five First Aero Squadron pilots, thirty enlisted men and three Burgess aircraft deployed from North Island Field back to Fort Crockett. This unit, designated the 1st Company, 1st Aero Squadron, left San Diego by rail on 26 April 1914, arriving in Texas four days later. First Lieutenant (Dr.) Adna G. Wilde accompanied the 1st Company, thus becoming the first U.S. military physician clearly identified as deploying with a unit to support possible combat flying operations. However, the expedition literally never got off the ground. The men and machines were not needed because the crisis in Mexico passed, and the detachment departed Texas for San Diego on 13 July 1914 without ever uncrating their aircraft (Hennessy, 1985, p. 105; Nuhn, pp. 56-58).

Army aviation briefly returned from California to Texas in April, 1915 when two pilots took one plane to Brownsville, Texas for border patrol duty. The first reconnaissance flight was a twenty-minute sortie to determine the position of General Francisco ("Pancho") Villa's entrenchments around Matamoras, Mexico, across the border from Brownsville. After several other flights during the next 47 days, the detachment returned to North Island when Villa withdrew his forces and the local U.S. Army Field Artillery unit was recalled to Oklahoma (Hennessy, 1985, p. 145). The artillery unit probably provided medical coverage for the deployed fliers.

American military aviation grew very little during the next two years. One manifestation of this growth was the formation of the First Aero Company at Mineola on Long Island, New York in the summer of 1915. This location had been the site of some training by the Aero Club of America, a civilian organization organized in 1905 to promote American aviation. The Aero Club had begun by sponsoring balloon races in 1906 and 1907 won by pioneer Army aviators flying distances of over 400 miles. One of the winners of the first race was Major Henry B. Hersey, a man famed as a cavalry troop commander in Teddy Roosevelt's Rough Riders in Cuba during the Spanish-American War. These aerial events (which included the Bennett Trophy races) commanded much public interest at all levels.

Because of the interest and activities of many well-known New York businessmen and Ivy League academicians, the Aero Club established a strong and continuing presence in matters of military aviation. The Mineola airfield became an aviation center of some influence, and the First Aero Company was mustered into federal service in anticipation of service on the Mexican border. The unit never deployed, however, and the army mustered its members out

on 2 November 1916 without their having reached the border. Mineola continued its military training activities during the cold winter months, housed only in tents. We have no information about its medical facilities or support during that period except the mention that one of the five permanent buildings being constructed there in early 1917 was a hospital (Hennessy, 1985, pp.131-2, 177). When Col. Theodore C. Lyster, a pioneer in aviation medicine, formed the army's medical research board later that year, he chose Mineola as the location of its new laboratory because it was near the embarkation ports of the American Expeditionary Force, and had access to Air Service training facilities and flying fields. The laboratory opened in January 1918 (Noe, pp. 35ff).

Although aerial combat in Europe had been active and well-publicized since 1914, the U.S. Army still had only one full squadron in operation in 1916.[3] The First Aero Squadron, now commanded by Capt. Benjamin D. Foulois, had moved from its North Island field to Fort Sill, Oklahoma in July of 1915 to participate in artillery spotting maneuvers, and then transferred to Fort Sam Houston in San Antonio, Texas. Foulois received orders to deploy its eight underpowered JN-2 and -4 "Jenny" aircraft in support of General John J. Pershing's punitive expedition into Mexico in the spring of 1916. This campaign came in response to Pancho Villa's raids across the border into the United States (Allen, 1954; Foulois, 1968, pp. 130ff; Nuhn, 1968; Sweetser, 1919, pp.33-4). Flying activities consisted mainly of liaison, communication, reconnaissance and redeployment flights. Two Hospital Corps medical technicians from Fort Sam Houston, joined by an Army physician, First Lieutenant S.S. Warren, and another enlisted medical technician from Fort Bliss in El Paso, Texas, deployed with this squadron as it traveled by train from San Antonio, Texas to Columbus, New Mexico (Cagle, p. 91-2; Maurer, 1978, p. 75; Nuhn, 1968, p. 101). The usual Army procedure of that day was to attach a medical officer for such duty without inquiring about his interest or experience in aviation, a practice that continued until the fall of 1918. No mention is made of Lt. Warren in any of the accounts of flights in Mexico and, given the inadequate aircraft, the dire flying conditions and the resultant multiple crashes of the Jennies, as well as the fact that no physicians were on flying status in the Army at that time, it is doubtful if Warren flew at all. No data concerning specific medical support to Foulois and his men appear in the medical section of the official history of this expedition (Allen, 1954, p. A-12ff).

Major Ralph N. Greene, a general practitioner turned neuropsychiatrist, accompanied his Florida Army National Guard Unit, the 1st Field Hospital of the 124th Infantry, to Camp Wilson, a cantonment adjacent to Fort Sam Houston in San Antonio, Texas in late 1916 or early 1917.[4] He was detailed, probably on local orders, to support the Fort Sam Houston

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[3] Sweetser calls it "the First, and only" Aero Squadron (1919, p. 134), and Allen corroborates this statement (1954, p. II-10). Sweetser goes on to note that it lost all eight of its "old and low-powered planes" to accidents in Mexico within about six weeks of flying. These losses were replaced with twelve new Curtiss N-8s and R-2s with 160-200 hp engines, costing $12,000 each. According to Foulois, the new aircraft were so poorly made and required so much testing that they never flew operational missions (1968, pp. 134ff).

[4] Armstrong refers to Dr. Greene being ordered to fly in 1916 (1943, p. 13). Greene's article about his experiences, published in November 1917, describes his training as having taken place "in the spring of this year." Greene's statement that Major B.D. Fulois [sic], chief aviation officer of the Southern Department, trained him in the spring of the unspecified year almost certainly places this event in the spring of 1917, not 1916. Foulois, a Captain in 1916, was away on the Mexican Punitive Expedition with the Army's only flying

aviation activities for 8 months in order to provide medical aid in the event of aircraft accidents. Greene developed a strong personal interest in the relation of medicine to aviation and made aeromedical observations on fliers there, vividly describing his chilly orientation flights over south Texas (Greene, 1917). During this period he earned his wings as a Military Aviator with the Third Aero Squadron (either at Fort Sam Houston or at the new base southwest of San Antonio that would later be named Kelly Field), thus becoming the first U.S. military physician to become a pilot. Greene went on to a distinguished career in aviation medicine, and later was the first airline medical director (Eastern Air Lines) and the second president of the Aero Medical Association, the forerunner of the present-day Aerospace Medical Association (Benford, 1955, pp. 37-41).

The first record of an American medical officer flying in combat (though not in a U.S. aircraft) concerns Dr. Malcolm C. Grow, a Philadelphia surgeon who, after serving in Russia with the American Red Cross, had volunteered to become a surgeon in the Czar's army with the rank of captain. Supporting the fight against the Germans on the eastern front during the winter of 1915-16, Grow flew at least once as an observer with a Russian pilot in a captured German aircraft. They made some reconnaissance observations over the German trenches and dropped a single bomb. The aircraft encountered enemy anti-aircraft and small arms fire in which bullets crackled "like fire in dry grass." The pilot finally made a forced landing between the Russian and German lines, and he and Grow sprinted to safety. The Russians had very few aircraft, and Grow was impressed with the results of this deficiency, writing that the Czarists had "a blind army, unable to tell what [the Germans were] doing while they were aware of every move we made." Narrowly escaping from Russia after the Russian revolution, Grow joined the U.S. Army and saw action again in France in October 1918 (Grow, 1918; Watson, 1992b). He had a distinguished career in the Army Air Forces in World War II, and became the first Surgeon General of the U.S. Air Force after it became a separate service.

A comprehensive 1917 review of combat fatigue, then known as shell shock, did not mention its manifestations in fliers (Viet, 1917). Lyster wrote in 1918 that the "honor rolls [names of dead aviators], which are usually hung up in each squadron headquarters, are too often a measure of failure, not of the aviator, but of those responsible for his fitness at the time of his crash" (Lyster, 1918). Thus, the wastage of men and aircraft during the early war years focused official attention on what was then known as "aeroneurosis," "flying fatigue" and "fear of flying" in all their various manifestations, rather than on physical fatigue and such poorly-understood physiological stresses as daily flights to altitudes between 15,000 and 20,000 feet without supplemental oxygen.

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unit, the First Aero Squadron, from April through August, 1916, and was in Washington, DC in September-November 1916, when he returned to Fort Sam Houston as Aviation Officer for the Southern Department (1968, p. 135). He remained there until the aviation buildup following the entry of the United States into WWI on 6 April 1917. The references to the *Third* Aero Squadron also place Greene's flights in 1917, since the First was the only squadron in existence in the spring of 1916. In corroboration, the official U.S. Air Force biographies of General Carl A. ("Tooey") Spaatz and of General Howard C. Davidson both refer to their serving with the Third Aero Squadron at Fort Sam Houston in May, 1917. The Third Aero Squadron was formed during the winter of 1916-17 (Mets, 1988, p. 20).

The leaders of every developing national air force during this era, by definition inexperienced in aerial warfare, came to understand that such flying required of its aviators something qualitatively different from the classical and traditional demands of combat upon warriors. This new element remains difficult to define clearly, but it includes the maintenance of a higher degree of cognitive, physiological, and performance capabilities than those previously required for conventional land or sea operations. An aircraft is notably unforgiving of errors in perception, interpretation, judgment, decision or performance. A mistake by a pilot can be suddenly lethal, whether it occurs in direct conflict or in ordinary flight.

Before the American entry in the war in 1917, U.S. Army physicians noted that each of the combatant air forces had developed some sort of aeromedical service. For example, an anonymous[5] analysis of British, French and Italian statistics at the end of the first year of World War I showed that of every 100 fliers killed, 2 died from enemy action, 8 from some defect in their planes, and 90 from individual deficiencies; 60 of these 90 deaths involved undefined "physical defects... As a result of these appalling findings, the British established a special service for the 'Care of the Flier'" (Wilmer, 1935). This new medical service provided no local flight surgeons, but assigned a medical orderly to each flying unit. At Brigade level, a medical officer with no special aviation medicine training decided upon the disposition of incapacitated fliers. Beginning in October 1917, the Royal Flying Corps (RFC) took over one ward at one hospital for care of such unfit fliers, with Capt. Dudley Corbett of the Royal Army Medical Corps (RAMC) in charge. Major James E. Birley RAMC commanded the RFC's medical organization in France. On their own initiative, Drs. Corbett and Birley learned much about aviation medicine, but "the two of them together could hardly give direct attention to the medical problems of the 53 squadrons scattered up and down the Front" (Robinson, 1973, p. 90). After the initiation of even such a tentative program, however, RFC losses from "defects" fell from 60% to 20% in one year, and to 12% in two (Wilmer, 1935, p. 117).[6] Unfortunately, we have no data to indicate whether these reductions in percentages were due to lives saved in accidents, to reduced numbers of

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[5] Despite considerable efforts, the authors have been unable to locate a primary source for these statistics, cited without specific attribution by Wilmer in 1920, and repeated in almost identical terms in Sheep (1921), Davis in (1923), Reinartz (1932), Beaven (1939), Armstrong (1950, Link & Coleman (1955, p. 11) and others up to DeHart & Davis in 2002 (12, p. 5). These numbers may derive from an unknown staff officer's analysis, passed on by word of mouth at the time (Allan D. English, Ph.D., personal communication to DRJ, 2000). Cooper points out that the British lost less than 100 fliers from the onset of hostilities in August 1914 to June 1915, mostly due to accidents or ground fire. One product of this low casualty rate was "an abnormal sensitivity to even slight increase in losses." (Cited from *Historical Records of the RFC, August 1914-June 1915* in Cooper [1986]). In 1920, Wilmer (p. 8) cited these statistics as coming from Sweetser in 1919, and also ascribes them to an analysis of the British Casualty List for the first year of the war. A detailed reading of Sweetser's book by one of us (DRJ) has failed to locate these numbers. Wilmer later cited these statistics (1935) as a reason for founding the U.S. Air Service Medical Research Board in 1917, *before* Sweetser's book was published. Wilmer wrote that Col. (later Brig. Gen.) Theodore C. Lyster, the Chief Surgeon, Aviation Section, Signal Corps, Major Isaac H. Jones and others went to Europe in December 1917 to investigate Allied work in "Medical Aviation," conferred with colleagues, and "brought back from the seat of war much valuable information, and many helpful reports." The British analysis may have been among these data (Wilmer, 1935, pp. 116-8).

[6] Dropping the proportion of losses due to "pilot defects" from 60% to 12% in two years is an amazing accomplishment, and one wonders what causes of losses increased to comprise the remaining 88%. Today, "pilot factors" under various names remain the major causes of aircraft accidents in every segment of aviation.

accidents, or to simultaneous increases in numbers lost from other causes such as enemy action. Other national air forces developed medical support plans based on similar experiences (Robinson, 1973, Chap. 3).

Still, aviation medical care was uneven. First Lieutenant Isaac H. Jones of the U.S. Army Medical Reserve Corps (MRC), another pioneer of American aviation medical, had long been interested in aviation:

> I had my first lesson in a 1915 pusher. You sat out in front and the wind struck you from head to foot—but it did not strike you very hard because you were only going forty-five miles an hour. ...I flew with Col. Harmon "across the whole state of Texas" (Jones, 1937, p. 217).

About one pilot's experiences early in the war, Jones commented on the need for medical support:

> Many of the pilots of the Allies had already seen active service before they entered aviation. For example, Col. Fred J. Martel is an American who enlisted in the Canadian Infantry in August, 1914. After eighteen months of trench duty, according to the standards of that day he was so worn out that he was considered to be fit "Only for Aviation." Having been at the front for a time, while flying over the lines at a fairly high altitude, he fainted. All he knew was that he was picked up by some French peasants. No doubt he had subconsciously made a fairly good landing—or else he had jolted his brain in such a way that afterward he had no memory of what had occurred. This often happens. In those days this was the way they found out if a man was fit to fly or not. If he had had a flight surgeon he would never have been permitted to fly at all. When we met Martel we had no problem explaining to him the need for a flight surgeon. He knew. (Jones, 1937, pp. 179-7)

A few physicians such as Drs. Kelley, Greene and Jones acquired some experience while on active duty, and a few even had personal flying training before coming into the U.S. Army (Peyton, p.30 ff). However, the Army had no policy concerning their duties in support of flying units; none had an official role beyond that of any other medical officer. Instead, the Army Aviation Section defined its aviation medical support only in terms of physical examinations for selection.

Even this simple step was a major innovation. Jones, writing later about these early days in an informal and informative way, described the situation:

> ...it was a long time before a single thought was given to [the study of the aviator]. As we look back, it is easy to see how the pilot himself was overlooked. In the early days everyone was absorbed in only one effort—to improve the airplane, to make it air-worthy, and to increase its speed. In other words, to make it safer and faster. The man to fly it was simply the one who had the nerve to try.
>
> For the first two and one-half years of the World War a pilot was not selected because of his fitness for flying. Long before we entered the War, Dr. [Theodore C.] Lyster noticed that the Allies were making aviators out of tired infantrymen, their soldiers who were exhausted from other war work, and even their wounded. The result was a terrible wastage—of lives and equipment. This is well known today; but Dr. Lyster had the vision from the very beginning. He felt that military flying demanded the best that a man could have and the best that a man could give.
>
> ... To this day there are many people who wonder what in the world the doctor has to do with flying. ...And yet, even from the beginning, the doctor has been essential. In fact the very first step in the selection was, and is, a medical problem—to find out the physical fitness of the candidate. Of course,

> Aviation Medicine began with the Aviation Examination. Dr. Lyster and I wrote this in May, 1917. It constitutes a careful study of an aviator—or of any other human being.
>
> During the War, the Navy and the Marine Corps adopted our Army Examination. Later, the Department of Commerce adopted it, in simplified form. The original was called "A.G.O. 609." "A.G.O." means "Adjutant General's Office." It now has a different number, "A.G.O. 64." (Jones, 1937, pp. 40-1, 47)

Major General William Crawford Gorgas was the Army Surgeon General from 1914 to 1918. Gorgas, along with Major Walter Reed and others, had been responsible for the medical research program that had discovered that anopheles mosquitoes carried yellow fever, the scourge of Central America. This discovery led to the program of mosquito suppression and personal protection that diminished the occurrence of the yellow fever and greatly facilitated President Theodore Roosevelt's Panama Canal project. Major Theodore Lyster, who was Gorgas's nephew, had served with his uncle in the yellow fever campaign that had helped clear the Canal Zone of this dangerous disease. A nationally known ophthalmologist, Lyster moved on to duty in the surgeon general's office as a consultant, and then was appointed to an additional duty as Aviation Section surgeon (Noe, 1989, pp. 24-25). As Jones put it:

> ...An act of Congress had granted to Dr. Lyster the privilege to retire from the Army "without disability" because of his work during the creation of the Panama Canal. He wanted to enter private practice. But he gave up the idea simply because he sensed that our country would be drawn into the War.
>
> ...The order which, in 1917, created this work of such far-reaching and lasting importance should be quoted:
>
> "Special Orders No. 207. War Department:
> Lieut. Col. Theodore C. Lyster, Medical Corps, now on duty in the Office of the Surgeon General, in addition to his other duties, is designated as the Chief Surgeon, Aviation Section, Signal Corps, United States Army." (Jones, 1937, pp. 178-81)

Either Gorgas or Lyster may have influenced the reassignment of 1/Lt. John P. Kelley from the Canal Zone to the new Aviation School at College Park (Chandler & Lahm, p. 197). Surgeon General Gorgas later recruited Jones into the new Aviation Medicine program:

> There came a night in a New York hotel. Maj. General William C. Gorgas always preferred to be called "Doctor Gorgas." ...it was in this hotel that I met "Doctor" Gorgas for the first time. Dr. Lyster and I had just finished writing the "A.G.O. 609." Dr. Gorgas said, "Theo, I need you with me in Washington." He then turned to me and said, "Lieutenant, you will take over the work of recruiting for aviation." (Jones, 1937, pp.182-3)

Jones embarked on a "circuit of the central states as far West as Denver and then around the rim of the U.S.A., going South along the Atlantic seaboard and then across and up the Pacific Coast." Everywhere, he discovered the "intense public interest in the Air Service." Telling local physicians in each city of the need for examination of aviation candidates, he would select a local doctor who would then be commissioned into the Army and placed in charge of the unit. Civilian consultants were identified and organized into groups for different specialties. Jones instructed all the physicians that each unit would perform the same examination, the A.G.O. 609, and all would use the same professional instruments to study the applicants, thus insuring a standard procedure. *This process, new to military medicine and perhaps to medicine itself, established the foundation for aviation medicine.*

As he put it, "The best doctors in each city were eager to do this work. Only by having capable physicians was it possible to rely on the carrying out of the standard tests. All the hundreds of us doctors who examined pilots at this time had the satisfaction of knowing that the horde of applicants had a square deal" (Jones, 1937, pp. 185-6; see also Noe, 1989).

Thus, a few far-seeing Army physicians addressed the challenge of building an Air Service from the ground up, based upon the experiences of the Allies and the few flying physicians in the U.S. Army such as Dr. Greene, and upon their own personal interest in aviation. The next challenge was to provide aviation medical support to the fliers selected and trained through this process. Lyster and Jones, both assigned to the Surgeon General's Office, worked out a plan for a semi-independent medical service composed of physicians trained in the human problems of aviation and attached to flying units in the field. Along with First Lieutenant William H. Wilmer, a Medical Reserve Corps ophthalmologist, Lyster and Jones developed the idea of training physicians in aviation medicine and assigning one, whom they termed a "flight surgeon," directly to support each flying unit, with orders requiring participation in flying activities and encouraging full flight training to become rated as a pilot (Craig, 1974; Robinson, 1973). Again, Jones explained the situation:

> Today very few people realize that we actually entered the War with practically no Air Service at all. All we had was an "Aviation Section of the Signal Corps," a mere handful of military aviators. A real Air Service did not develop overnight. However, in one year and a half, at the time of the Armistice, we had nearly twelve thousand pilots on full flying status. In other words our Army Air Service had more aviators than all the services of our allies and our enemies combined (Jones, 1937, p. 176).

6 April 1917-11 November 1918: The Great War and the U.S. Allied Expeditionary Force in Europe

How can the pilot be a complete master of his apparatus
if he is distracted in his mind, and his thought is elsewhere?
(Guibert, 1917)

The U.S. Army Aviation Section, which later became the Air Service, had only 52 trained fliers when the United States declared war on Germany on 6 April 1917 (English, 1996, p. 25). The U.S. went on to commission 11,438 flying officers during the World War I period (Link & Coleman, p. 8).[7] The formal establishment of U.S. aviation medicine paralleled the growth of the Air Service as a part of the immense airpower expansion supporting the U.S. entry into the war.[8] The few aviation medicine-oriented officers on active duty in 1917

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[7] Sweetser reports the following cumulative statistics. From its inception in 1908 until 30 November 1916, the U.S. Army Air Service had examined 222 applicants, accepted 141, relieved 33, and had one resign. Of those accepted, 14 had been killed (10%) and 93 were still on active duty, including 45 qualified aviators and 43 students. The fliers included 3 majors, 9 captains, and 33 lieutenants. Of the 121 aircraft delivered during these eight years, 21 had crashed, 27 were out of service, and 73 were available. Sweetser adds that 302 were on order (Sweetser, 1917, p. 40).

[8] The story of this unprecedented buildup of airpower is far beyond the scope of this paper, but perhaps a few statistics will indicate its scale. On 30 July 1918, at the inauguration of the final and victorious Allied campaign, the newly arrived U.S. Army had 5528 planes in Europe. The other Allies had 5258: 2820 French, 1664 British, 614 Italian and 160 Belgian. Germany and Austria together had 3309 aircraft to oppose the total

proceeded to organize and staff 67 physical examination centers around the country within a few months, as we have seen. These pioneers also established the new Medical Research Laboratory on Long Island at Hazelhurst Field near Mineola, New York. This was in part due to:

> [D]etailed information...obtained [in August 1917] by our Air Service from the Royal Flying Corps, giving data upon the marked nerve instability that developed in flyers fighting at the front, and on the effect of this instability in reducing the efficiency of the fighting forces. This led to a study of the *effects of altitude on man* and *its relation* to those deteriorations of *mental* and *physical* activity, which were evident factors in causing marked reduction of fighting power of various squadrons on the front (Davis, 1923, emphases in the original).

William H. Wilmer, who had entered active duty as a major, became the first Laboratory commander in October 1917. As the Laboratory was opening, Colonel Lyster and Major Jones, both newly promoted, sailed for Europe along with Majors Harris Mosher and George de Schweinitz (Link & Coleman, pp. 11, 17). They spent five months overseas (December 1917 to April 1918), "visiting aviation units at the front, collecting first-hand information upon Allied experience with medical problems and the facilities available to treat them" (Wilmer, 1935, pp. 117-8; see also Jones, 1937, pp. 188-222; Peyton, 1968, p. 9). The group visited British, French and Italian medical facilities furnishing support to aviation units and talked to both physicians and pilots. Jones later wrote in great and informal detail about these visits:

> In different squadrons at the front I had quiet talks with many pilots. They seemed to realize that I was there to learn—from those who knew. They could sense that I was not up there to lecture to them. They would tell me about the condition of their associates. One pilot would say, "You see that chap over there—his nervous system is shot to pieces." Most of these men were mere youngsters, but they had learned about life and character—and in such a short time. The mental and physical state of many of them was so obvious that even their fellow pilots could make a "diagnosis." They needed no medical knowledge to realize that this man or that man was, at least for the time being, unfit for combat flying.
>
> Then where was the trouble? Simply this: How could any pilot go to his commanding officer or to his regular medical officers and say: "I do not feel equal to my work. I would like to be excused and go back to Paris!" This was the first thing that struck me—it simply could not be done. No man would put himself in a position to be thought "yellow." That was the situation—not only tragic, but a waste of seasoned pilots and expensive material. From the crude standpoint of money alone, a military pilot is expensive. To train him runs into tens of thousands of dollars, and—as the pilot himself would be apt to express it—all this is lost when he becomes a "finished" product.
>
> The answer was the Flight Surgeon. ...The ideal flight surgeon would need to know his Aviation Examination—"A.G.O.609"; he must have a post-graduate education in the problems of flying, and above all, he must have a nature that would make his advice valuable to the commanding officer and a personal character that would command the personal confidence of the pilots, so that they would instinctively come to him with their difficulties. This extraordinary creature then needed a military name or title. Col. Eugene R. Lewis and I were instructed to choose this name. We knew that all military doctors are called Surgeons, so we chose the term "Flight Surgeon"—the doctor that has to do with flying. (Jones, 1937, pp. 208-9)

Allied forces of 10,786. As an indication of its new-found confidence in air power, the U.S. had 672 planes per 100,000 infantry, compared to the French 374 and the British 294 (Sweeetser, 1917, p. 235).

Jones later wrote about the mixed reception of this new concept from "certain ones high in authority who opposed Aviation Medicine and who thought that the flight surgeon idea was just nonsense:"

> Yes, they are against it. They have looked the matter up carefully and find there is no *precedent* for aviation medicine. They tell us that there had never been a flight surgeon in the Civil War or even in the Spanish War (Jones, 1937, p. 212).

Such skepticism was the exception. Lyster sent Jones to flying fields throughout the country to explain this new concept:

> ...to tell each commanding officer about this new creature that would soon be attached to his command. To our real surprise there was practically no trouble at all. Almost all flying officers were enthusiastic. They could see that the flight surgeon was the answer to this new problem—the fitness of the fliers under their command. In short, those that "knew flying" welcomed a medical officer who also "knew flying" (Jones, 1937, p. 211).

Line officers soon endorsed the work of the Medical Research Laboratory at Mineola, which had been well accepted by June 1918. Equally effective was the work of the flight surgeons assigned to Branch Laboratories—the forerunners of today's Flight Surgeons Offices—that had been established at many flying fields around the United States.[9] General John J. Pershing, the commander of the American Expeditionary Force (AEF) in Europe, cabled a request for similar aeromedical support to his flying units. In response, Col. Wilmer and a detachment made up of 33 medical officers (including 16 newly-trained flight surgeons) and 15 enlisted men sailed for Issoudun, France on 6 August 1918 (Wilmer, 1920, p. 16).[10]

The huge American base at Issoudun had already been visited almost a year earlier by Col. Theodore Lyster and possibly other medical officers in his party during their fact-finding trip. Lyster's cousin, Major Thomas L.B. Lyster, was in charge of construction there, and later directed the Air Service Projects and Designs Committee. Roland Richardson, Theodore Lyster's nephew, was assigned there as a construction officer, as was Quentin Roosevelt, son of the former President; in fact, Richardson and Roosevelt were the only two American officers there who spoke French. The two young officers soon volunteered for and were accepted into flight training. Richardson kept a lively and detailed diary of his experiences in France, and wrote of seeing "Uncle Ted" in November 1917 while in flying training at Tours, and again in January 1918 (Richardson, 1919, pp. 11, 14, 22ff, 167).

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[9] The first U.S. Army physician assigned to official flying status as a flight surgeon was Capt. Robert J. Hunter, who reported for duty at the United States Aviation School, Park Field, Memphis, Tennessee on 13 May 1918 (Hunter, 1918 [cited in Medical Service Digest, 1967]; Hunter, 1942; Peyton, 1968, p. 31). Others soon followed.

[10] The first death of a flight surgeon in an aircraft accident occurred while Wilmer and his men were en route to Europe. Captain William R. Ream, USA, MC, received flight training at Rockwell Field, formerly North Island Field, in San Diego, beginning in 1916. This was about the same time that Dr. Ralph Greene learned to fly in Texas. Ream, promoted to the rank of major, received both his Reserve Military Aviator (pilot) designation and his formal flight surgeon designation in 1918. On 24 August 1918, he died when the aircraft in which he was flying as a passenger spun to the ground from an altitude of about 100 feet while trying to land in a cornfield near Effingham, Illinois during a rainstorm. Lieutenant Wesley Benner, the pilot, survived with serious injuries. On 14 October 1918, the War Department changed the name of Oneorata Aviation Field, located south of San Diego, to Ream Field (Beaven, 1939; Costin, 1963).

Most U.S. aviators of the day received about 50 hours of flying training in the U.S. and the rest of their training overseas, though a few received all their training in Europe. Issoudun, where most of this advanced training took place, contained the largest flying base in the world at that time: 9 operational fields, with more under construction, covering more than 36 square miles and operated by over 5000 personnel. Air Service statistics showed that every 721 hours flown by the 3000 or so U.S. aviators in Europe at the time resulted in three aircraft lost from accidents or enemy action, and one fatality. The 575 pilots in training or instructing at Issoudun flew about 500 hours per day, and 17 men died in crashes in August 1918 (Wilmer, 1920, p.17; Peyton, 1968, pp. 33ff). These numbers yield a crash fatality rate during training at this location of about one death per 912 hours, none due to enemy action. The crash fatality rate during training in the U.S. at this time was one death per 2960 hours (Sweetser, 1919, p. 268).

Col. Wilmer and his medical officers arrived at Issoudun on 2 September 1918. That afternoon they toured the base, collecting information on the health of the fliers, the flying conditions, and the accident situation. The next day they started working to solve the problems they found. Ever since the arrival in France of the AEF Air Service in 1917, its pilots had been required to request the permission of their commanders before consulting a physician (Peyton, 1968, p. 34). Soon after the arrival of the new AEF Medical Research Laboratory,[11] Major Lamphier, the executive officer of the main airfield of the Third Aviation Instruction Center (AIC) at Issoudun, requested that a flight surgeon be specifically designated to support his aviators. The modern concept of the operational flight surgeon achieved reality when Col. Wilmer posted Maj. Robert R. Hampton, MC, to that organization, the first flight surgeon ever assigned to a specific flying unit in a combat zone. This occurred on 17 September 1918, less than two months before the end of the war (Wilmer, 1920, p. 17). Major Hampton was shortly joined at the 3rd AIC by two other flight surgeons, and soon thereafter Major Richard Perry was posted to the 2nd AIC at Tours, and Major Theodore S. Blakeley to the 7th AIC at Clermont-Ferrand (Wilmer, 1920, pp. 29, 48). No records appear concerning their flying activities or hours flown at these training bases. The new aeromedical efforts yielded rapid and measurable results: in the month ending 15 October 1918 the student pilots at Issoudun flew almost 2000 hours more than they had during the previous month. From 3-15 October they flew 4436 hours without the death of a single flier (Peyton, 1968, p. 36), a better record than the U.S. rate of one death per 2960 hours. If the fatality rate prevalent at Issoudun during August had continued, five fliers would have died during those 12 days in October. Assuming that no other major changes in training operations had occurred from the end of August through mid-October, one may conclude that the addition of aeromedical services resulted in increased productivity and increased safety.

> The cordial reception of the [aeromedical] work by this aviation center [Issoudun] is well illustrated by the following editorial in the "Plane News": "Investigations of the Medical Research Board...have shattered the long-time belief of aviators that Fate is responsible for the large number of aviation casualties. Pilots formerly believed that when their time came to be 'bumped off' they would be 'bumped off' regardless of how they attempted to guard against fatalities. Absolute scientific researches...have proved that this is not

[11] Wilmer refers to this unit both as a Medical Research Laboratory and a Medical Research Board without clearly distinguishing whether these were distinct subordinate organizations (Wilmer, 1935).

true. *The board is no longer an experiment.* It has saved hundreds of aviators thus far and with the cooperation of the pilots themselves will save hundreds more. What is necessary, is for the pilots to thoroughly understand that the board is not here to grab them off the flying list. The board was created to advise and co-operate and to assist aviators in saving themselves" (Wilmer, 1920, p. 18; Beaven. 1938) [emphasis added].

Why did the pilots so readily accept these innovations? Perhaps the most explicit description of the previous conditions came from a letter from Lyster's nephew Richardson at Tours to his mother on 30 May 1918:

> I wish they would put all those good ideas of Uncle Ted's into effect over here, about rest etc. for the aviator, for it is all true and you have no idea what a serious strain flying is and one gets so little exercise to go with it, especially like at [Issoudun's] Field 8, where the Captain wouldn't even let us out of the camp and we stayed in our barracks for nearly two weeks of bad weather and couldn't hardly move and then when we did fly, good night, one half of the class busted up one way or another and that darned fool Captain didn't have enough sense to know why but blamed us, you couldn't tell him either. Lots of these birds have funny ideas about flying, funny too they are the ones that don't care to fly, not even as a passenger, but luckily sooner or later they got bounced...I'm just telling you these things so you will realize just what flying means to a fellow, and you can't really understand it until you have flown yourself, for its [sic] so very different from anything else...each new stunt [acrobatic maneuver] starts the same feeling in your insides and believe me you are glad when its all over. Of course now stunts are an every day occurrence, but then—well, I really can't explain what you really feel like, it is so absolutely different than anything else you have ever done. All this is to show you that aviators really need special and the very best medical and mental attention (Richardson, 1919, p. 72).

Richardson later encountered Wilmer at Issoudun and reiterated his high opinion of the new medical system to his mother on 11 December 1918:

> Was sent back to Issoudun for a physical exam similar to the one we took on entering the flying game. This was for statistical reasons only to see what effect our flying on the front had on us physically and mentally. This by the way was done by a board of doctors sent over by Uncle Ted for the care of the flier of which he had told you all ready [sic]. They are doing fine work too and are a fine bunch of men. Everybody that had had anything to do with them says the same thing, and all the fliers are very much in favor of the idea and of the work they are doing, so you can tell Uncle Ted that at least his goal has been successfully reached and if they would have let him have his way before[,] many lives would have undoubtedly been saved, but such is the Army.
>
> Well they were to class the men as A, B, C, and D, according to their physical and mental fitness and furthermore they were to go home the reverse of these letters, i.e. the As last so we were all very desirous of being put in class B or C, just to get home soon. Well as luck would have it I drew an A, but I ran across a Major Patton [probably Maj. William C. Patton, MC, who accompanied Wilmer from Mineola to Issoudun (Wilmer, 1935, p. 133)] who had examined me in Washington to get into the Service. Well he and I had quite a talk and he took me in to see Colonel Wilmer who is in charge of the board and he told me that the latest news was that we were going straight home as soon as they could collect all our records, etc. and get out the orders, so here we are still at Issoudun waiting (Richardson, 1919, p. 138).

Upon his departure from Issoudun in December 1918, Col. Hiram Bingham,[12] the Center commander, wrote the following words to Col. Wilmer and his staff:

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[12] Bingham had been a Yale professor and Andean explorer who discovered the Inca ruins at Machu Picchu before the war. He learned to fly as a civilian in April 1917, joined the Army in May 1917, became active in planning its new flying training program, and soon was in command of the huge facility being built at

> Before leaving this post, I want to [tell] you how greatly I have appreciated the cooperation and aid which the Medical Research Board has given us during the past four months... That we should have been able to break records in graduating pilots in October under a heavy strain and at the same time reduce the number of accidents and increase the morale of the aviators was due in such a large measure to your wisdom and counsel, that we are all of us under a great debt of gratitude to you... (Quoted in Wilmer, 1920, p. 33)

Thus, the first operational unit flight surgeons were assigned at the request of responsible local line commanders, and the effects of aeromedical support were immediately apparent to the most closely involved line officers in terms of increased operational productivity and decreased accidents.

Until the arrival of the Medical Research Laboratory in Europe, medical officers untrained in aviation medicine had been randomly assigned to flying squadrons at their ports of debarkation from the U.S. (Wilmer, 1920, p. 15). Wilmer later contrasted the quality of the support furnished to flying units by these medical officers with the care furnished by the flight surgeons. He wrote one of the few contemporary and authoritative observations made upon units flying without trained aeromedical support, here quoted in its entirety:

> [The assigned physicians] were, as a rule, a body of fine young men—bright and eager to serve. But their want of knowledge of the special problems of medical aviation lay heavily upon them, and they welcomed the plan of instruction in these problems [see below]. They usually lived together, but apart from the fliers. They felt a lack of confidence in their own judgment of a flier's fitness, and therefore were not keen to be thrown with the men. They feared to take a flier from duty, and, conversely, they dreaded to keep him flying when they had a feeling of uncertainty of his real condition. This lack of confidence in their own judgment rather engendered a feeling of uncertainty on the part of the fliers. Altogether, there was not the team work and feeling of mutual confidence that would have existed if the medical men had been thoroughly familiar with the technical and medical problems of flying. There is no other part of the military establishment in which team work adds more to general efficiency than at the flying fields (Wilmer, 1920, p. 51).

Col. Wilmer's observations on the inability of non-flying medical officers to provide adequate care for fliers in an operational environment are unique within the aeromedical literature. His views are echoed in the lay literature by Col. Thomas R. Boggs,[13] the Medical Consultant to the Air Service in the AEF, who corroborated Wilmer's comments in a detailed official report dated 28 December 1918 on the aeromedical support to the AEF Air Service. In the official Air Force history of the U.S. Air Service in World War I, Boggs's remarks are quoted in detail (Maurer, IV, pp. 277-91). Boggs's first two

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Issoudun, assuming command from Maj Carl A. ("Tooey") Spaatz (Mets, 1938; Sweetser, 1919, pp. 55ff). One may speculate that, new to the military, Bingham had no preconceptions about the role of aviation medicine and was glad to receive any help with his task. He went on to become a U.S. Senator, and is buried in Arlington National Cemetery (Sweetzer, 1919, pp. 23-37; http://www.britannica.com/seo/h.hiram-bingham/, http://www.findagrave.com/pictures/4628.html).

[13] Dr. Boggs was an associate professor of clinical medicine at Johns Hopkins University and chief physician of Baltimore City Hospital when he received his commission as a major in the Medical Reserve Corps in 1917. He went to Europe in June 1917 as chief medical officer of Base Hospital No. 18, the Johns Hopkins Unit. He later reported to the AEF Surgeon on the work of the medical department of the Royal Air Force. In July 1918 he was directed to make a similar review of the existing medical support to the AEF Air Service. Based on his report concerning its need for improvement, he was appointed its Medical Consultant on 8 September 1918 (Maurer, 1978, Vol. IV, pp. 277ff).

recommendations clearly define the situation and the administrative conflicts that would continue until the creation of a separate Air Force in 1947:

> 1. In order to arrive at a just appreciation of the needs of the Air Service from the medical standpoint it is essential to keep in mind that this branch of the service is fundamentally different from any other. The character of the duty demands a very specially selected personnel, which is peculiar not only in physical but in mental makeup. To this is added the factors arising from the small size of the basal unit, the squadron, and the isolation demanded so frequently in order to obtain landing fields and concealment of hangers. Lastly, even the enlisted personnel differs [sic] from the other services in the combatant troops in containing a large percentage of highly trained technicians, not readily replaceable. It is obvious, therefore, that the medical organization planned for the Army in general may fail in some particulars to meet the very specialized needs of this service.
>
> 2. The difficulties met in the general medical service are principally two. The first is in commissioned personnel, there being a dearth of specially trained and adapted men for this duty; and furthermore, the transfer of medical officers from one arm of the service to another which is unobjectionable in general is quite impractical in relation to men once trained for a very special service. Again, the dependence of the medical service with the aviation units upon the Division, Corps, Army or Section Surgeons, leads to difficulties from the lack of interest, understanding and sympathy with its special needs and demands. It is only natural that many men in responsible officers [sic] with the Army as a whole, object to the special demands made and are annoyed by the privileges granted to this branch. Thus, purely personal reactions of individuals in high executive position may lead to serious handicaps. The sudden injection of a radically new member into a well crystallized formation may well be expected to produce such results.
>
> The remedy for these difficulties would seem to lie in the separation of the personnel and property and channels of communication into a distinct division of the general medical service, or the placing on the staff of each Army, Corps and Section Surgeon of a specially qualified officer who should handle directly for this surgeon the business of the aviation section, with of course a corresponding chief, as a representative of the Chief Surgeon and the Surgeon General. Should Air Service as a whole be separated from the Army and Navy the solution would be simplified (Maurer, 1978 Vol. IV, pp. 277-8.).

Even when the problems unique to fliers became manifest, unit physicians untrained in aviation medicine were unable to deal with them. Further, the initial official policy—fliers had to consult their superiors before seeing the medical officer—almost guaranteed that medical resources would be underused. Long military experience has taught repeatedly that regarding *medical* problems as matters for *disciplinary* response (venereal diseases, obesity, trench foot) will result in the soldiers denying or concealing the conditions, or seeking unofficial and possibly ineffective remediation. An aeromedical example of such a response is the heavy drinking of aviators in combat, once tacitly condoned, but now known to be counterproductive and detrimental.[14]

When physicians were trained in the principles of aviation medicine, assigned to specific flying units, lived with "their" aviators and flew with them, the results were, and remain today, striking and consistent. Within a week or two, the fliers and the flight surgeons formed a bond of mutual trust and respect: professional to professional and person to person.

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[14] In Boggs's words, "There is no genuine evidence to support the contention of a few well meaning but inaccurate proponents of the view that the flying man may be benefited by moderate or even excessive doses of this drug [alcohol]. The contrary position, viz: that the flying man should be a total abstainer has the support of scientific demonstration and practical experience, and by rule and example every effort should be made to banish the use of alcohol." He went on to comment on the detrimental effects of smoking upon visual acuity, and the salutory effects of intermittent rest and recreation (Maurer, 1978, IV, pp. 227-8).

(In mental health terms, these are matters of *transference*.) Wilmer clearly depicted this bonding in his writings, as did the reports of his subordinate flight surgeons that he quoted at length in his book (Wilmer, 1920). Fliers soon learned that the flight surgeons were there, not to ground them, but to keep them flying safely and effectively. Groundings, usually temporary, were a part of that process, but were not the *point* of that process.

Medical officers flew in order to "learn the physical and mental effects of flight," and consulted with instructor pilots and combat veterans on operational problems (Wilmer, 1920, pp. 51-2). Maj. Gen. Mason Patrick, Commander of the AEF Air Service, Brig. Gen. Benjamin D. Foulois and Col. Billy Mitchell, among other Air Service field commanders in Europe, endorsed the work of the flight surgeons already in place and asked that more be assigned (Wilmer, 1920, pp. 20, 24, 34). Wilmer's "plan of instruction" to remedy the American aeromedical situation in Europe refers to the opening of a School of Aviation Medicine at Issoudun to instruct medical officers in aviation medicine. This School had graduated three new flight surgeons when the war ended on 11 November 1918.

American aeromedical efforts abroad ended when the Laboratory closed on 19 February 1919 and its personnel returned to the U.S. No U.S. operational combat flying units had received flight surgeons by war's end, although plans were in place for this to be accomplished in time for the Allied offensive that had been planned for the spring of 1919 (Wilmer, 1920, pp. 24, 50). The assignment of flight surgeons to a combat support role remained an idea whose time of practice was yet to come. However, line commanders from the Chief of the Air Service in the AEF down to squadron executive officers had endorsed the policy of assigning a designated flight surgeon to each flying unit, and even the skeptics were convinced of their value.[15]

1918 to 1941: The Period Between the World Wars

After the Armistice, the team of William Wilmer, Theodore Lyster and Isaac Jones quickly dissolved. Wilmer returned to Washington where he received the Distinguished Service Medal from General Pershing himself. The Army honorably discharged him on 15 May 1919, and he returned to the practice of ophthalmology in Georgetown. The William Holland Wilmer Foundation, formed by a group of patients and admirers, later raised four million dollars to endow the Wilmer Ophthalmological Institute at the Johns Hopkins University in Baltimore. Now a Brigadier General in the Medical Corps Reserve, Wilmer became a professor at the Johns Hopkins Medical School, serving with distinction until his retirement in 1934. Lyster and Jones left the service to form an eye, ear, nose and throat clinic in California. Like Wilmer, Lyster became a Reserve Brigadier General (Peyton, 1968, p. 40-44). All three men served as vice presidents of the Air Service Medical

[15] Wilmer reports a conversation with Lt. Col. Rader, the commander of the base at Clermont-Ferrand, during a visit there on 13 October 1918. Regarding flight surgeons, Rader said, "At first I was very much opposed to them in the States. I feared that they would be butting in on something they knew nothing about. But before I left [the U.S. for his assignment in France] they had demonstrated their value to such an extent that I have a note in my pocket to take up the question of having one sent to this field" (Wilmer, 1920, p. 25). Rader's request was soon filled by the assignment of Maj. Theodore Blakeley, the third flight surgeon to receive an operational assignment (Wilmer, 1920, p. 48).

Association of the United States, which preceded organization of the Aero Medical Association (Benford, 1955, p. 11).

Major Louis Hopewell Bauer succeeded Wilmer as the commander of the School of Aviation Medicine. After joining the Army in 1913, Bauer had served first on the Texas-Mexico border and then in the Philippines. When the war began, he returned to the U.S. to become an honor graduate of the School of Aviation Medicine, receiving an assignment to the new flying school at Kelly Field in San Antonio. He served there throughout the war. When Wilmer left the service in 1919, Bauer responded to a call from Washington for an experienced flight surgeon to command the School, recently relocated from Hazelhurst to the nearby Mitchel Field, Long Island (soon renamed Roosevelt Field in honor of Quentin Roosevelt, who had been killed in action in France).

It must have been a frustrating assignment. The School's teaching and research functions continued but diminished as its staff shrank to seven officers and eight professional civilians, plus technical assistants, during the post-war era. School productivity dropped: from a maximum of 19 published papers in 1919 to five published papers in 1925. These papers were increasingly oriented toward practical flight surgeon functions such as examining, classifying and selecting pilots. The physical plant suffered almost complete destruction by a fire in February 1922 that consumed all its documents and archives. Bauer left the School to attend the Army War College in 1925 and then resigned to accept the position that we now know as that of the Federal Air Surgeon in 1926. He published his textbook, Aviation Medicine, based on his experience in the Army (Bauer, 1926). That same year, the School moved to Brooks Field and later to Randolph Field, both in San Antonio, Texas (Benford, 1955, pp. 10ff; Peyton, 1968, pp. 40ff). Struggling for survival during the lean years that followed, its flight surgeon classes shrank and its research effort shifted to the mental health aspects of aircrew selection, including personality evaluation and psychomotor testing, plus a growing emphasis on research into instrument flying and into airsickness.

The larger focus of aviation medicine between the World Wars shifted from Wilmer's and Bauer's emphasis on examination procedures and selection criteria to research in problems involving altitude physiology, acceleration forces and motion sickness, with consequent attention to matters of personal equipment and human engineering in aircraft design in the mid-1930s. One may fairly link this change in focus to the change in military aeromedical leadership from Bauer to the Grow-Armstrong team, a major theme of Noe's dissertation (1989, see especially Chap. IV).

The early work of Malcolm Grow, who served as a flight surgeon at Wright Field, Ohio was augmented by the arrival of Harry Armstrong in 1935. Grow left for Washington later that year to become Chief Surgeon of the Air Corps. Armstrong continued his research almost single-handed for the next five years, supported by Grow. The work in Ohio tended to be more technical in nature—altitude physiology, parachute development, g-force resistance—than that in San Antonio. Armstrong was joined in 1936 by John W. Heim, PhD, a Harvard altitude physiologist and in 1940 by Capt Otis O. Benson, MC, who had trained at the Mayo Clinic and with physiologist Bruce Dill, PhD at Harvard. These men proved crucial to the

rapidly increasing capability of the aircraft of that era (Peyton, 1968, pp. 86ff; Noe, 1989, pp. 191, 219ff). As we shall see, the Grow-Armstrong team rejoined and flourished in England soon after World War II began.

The United States Air Service became the Army Air Corps between the world wars, but its aviation medicine support declined. Three candidates enrolled in the School of Aviation Medicine flight surgeon class beginning September 1923, and two in the class beginning September 1929. At one point, Congress wanted to limit the total number of flight surgeons on flying status to five (Bauer, 1935, 1940, 1951). About 15 flight surgeons were trained in each of the next 21 years; about 10 per year were Army medical officers. Had it not been for a few reserve officers and foreign students in training, the School might have closed during the Depression years (Armstrong, 1969). Aeromedical support moved or was reorganized at headquarters level at least six times, and only a few flight surgeons continued to fly. Link & Coleman have fully documented the story of these reorganizations and the varying views of flight surgeon functions (1955, pp. 20-38, 24). They reflect the influences of the military draw-down after WWI, the Depression, the rivalry at all levels between flight surgeons and non-flying military physicians that Boggs had foreseen in 1918, and the ongoing movement toward a separate Air Force.

Minutes of the meeting of the Aero Medical Association (forerunner of the present Aerospace Medical Association) in 1935 reveal that "very few" flight surgeons were on flying status. The Association sent a resolution to the President of the United States and other dignitaries urging "Congress and the War Department to realize the absolute necessity and wisdom of placing on flying status...all [military] flight surgeons...with aviation units." It went on to recommend correction of "the present unwise discrimination which deprives flight surgeons from gaining experience in the air by flying and accompanying on flight missions the units to which they are attached" (Benford, 1955, p. 63). No official action was taken, and so the resolution was repeated at the Annual Meetings in 1936, 1938, 1939 and with another letter to President Roosevelt on the subject in 1940 ((Benford, 1955, pp. 74, 84, 124, 129-30).

A turning point occurred in late 1939 when General H.H. Arnold stopped in Hawaii on his way to the Philippines. His B-17 crew spent the evening celebrating their presence in the Islands, and Lt. Col. Eugen G. Reinartz, flight surgeon for the Hawaiian Department, declared the entire crew medically unfit to fly the next morning. Arnold overruled him and the flight continued. Upon his return to Washington, Arnold directed a study of "the whole flight surgeon problem in the Air Corps." He appointed a Board consisting of Lt. Cols. David N.W. Grant, Malcolm C. Grow and Fabian L. Pratt, all flight surgeons.[16] The Board

[16] For all his irritation, Gen. Arnold, himself the son of a family physician, appointed experienced and trusted senior flight surgeons for this evaluation. Grant went on to become the first Air Surgeon. Grow and Arnold were old friends. In July 1934, Grow served as flight surgeon on Arnold's 8290-mile round-trip mission of ten Martin B-10 bombers from Washington, DC to Fairbanks, Alaska and back. This mission was undertaken to restore public confidence in airpower, which had been shaken by the 50 crashes and 12 deaths earlier that year resulting from the Army's attempt to carry U.S. air mail. Grow's diary remains the only personal account of the successful Alaska mission (Watson, 1992a). Pratt was an early flight surgeon who had earned his pilot wings in 1926 and who commanded the School of Aviation Medicine at Randolph Air Base in San Antonio in 1939 (Mapes, 1991). Reinartz's career did not suffer as a result of his professional decision in Hawaii: he

endorsed the flight surgeon concept and recommended training 36 new flight surgeons each year in the Regular Air Corps and 27 in the Reserve and National Guard. The Board further proposed that the pay of flight surgeons should be increased to parity with other flying officers, their enlisted support bolstered, their non-flying duties reduced, and that suitable flight surgeon insignia be designed. Although the inquiry grew to involve the whole matter of separate medical care for fliers,[17] the Air Corps adopted all of the Board's recommendations (Eugen G. Reinartz, MD, Brig Gen MC USA [Ret.], personal communication to Residents in Aerospace Medicine including DRJ, 1963; Link & Coleman, 1955, pp. 26-8). The general military expansion for war readiness played a large part in implementing these changes. They culminated in the transfer of Col. David N.W. Grant in 1942 from the Office of the Surgeon General of the Army to a separate position as the Air Surgeon, reporting to the Commanding General of the Army Air Forces, Gen. Arnold (Link & Coleman, 1955, p. 37).

Impending combat is a potent stimulus to military progress. As the likelihood of U.S. entry into WW I in early 1917 had lent urgency to developing the concept of the flight surgeon, along with an appropriate training curriculum, so in 1940 the growing possibility that the U.S. might enter the war in Europe rejuvenated the moribund flight surgeon training program (Kaplan, 1945; Wright, 1945). Reports in the *Journal of Aviation Medicine* concerning flight surgeon classes graduating from the School of Aviation Medicine, now located at Randolph Field near San Antonio, Texas showed that the number of graduates per class increased from 4 per class in March 1940 to 8 in the June class and 40 in the December class (Bauer, 1940). Later classes grew to such sizes that the Journal ceased publishing the graduates' names. Flying status for flight surgeons was no longer an issue: they flew.

In spite of all obstacles, aviation medicine had established its professional roots firmly in the scientific arena and in operational aviation in the U.S as well as other nations between the wars. Space permits the mention of only a few salient subjects. Study of hypoxia at altitude led to efficient oxygen masks and to pressurized cabins. Flight surgeons clarified the causes of barotitis media ("ear blocks") resulting from pressure changes. Calibration of acceleration forces in flight and on human centrifuges yielded an appreciation of loss of consciousness from "blackout" and went on to new research on anti-g suits. Study of bailout procedures led to seat-pack and back-pack parachutes, and to the discovery of strong opening shocks in jumps at high altitudes. Carbon monoxide was identified as a serious hazard in cockpits.[18] Through the research efforts of Armstrong, who first published his "Textbook of Aviation Medicine" in 1939, flight surgeons made huge contributions to flying safety and effectiveness. Although their numbers were small, the cadre of experienced aeromedical practitioners at work between the wars formed the matrix of medical support for the huge expansion of the U.S. Army Air Forces in World War II (WWII). These men

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succeeded Pratt as School commander in October 1941 and held this prestigious and responsible position throughout WWII, supervising the training of some 5500 flight surgeons. He was promoted to Brigadier General in 1942 (Reinartz, 1966, pp. 28, 35-6; Peyton, 1968, p. 262).

[17] Skinner (1983) provides an excellent and detailed account of the political circumstances of this sequence of events, which are beyond the scope of this paper.

[18] Robinson (30, Chap. 4) gives a thorough description of these and other studies.

furnished the aeromedical leadership for thousands of operational flight surgeons soon to come.

No one knows how many fliers and aircraft have been saved by the aviation medical discoveries, inventions and training efforts of these pioneer flight surgeon scientists. One of their proudest traditions has been to subject themselves to the hazards they were investigating, and some have lost their lives in their pursuit of truth. The work of such military flight surgeons as Armstrong, Liljencrantz, Boynton, Moseley, Lovelace, Stapp, Simons and others exemplify the willingness of flight surgeons in each generation to share and investigate the hazards of flight with the aviators whom they supported in peacetime.

This peacetime practice led to the concept that military flight surgeons supporting combat operations should accompany their fliers at times as observers on combat missions. This practice, a logical extension of the general tenet that flight surgeons should participate with their aircrew in regular and frequent aerial flight, became a standard U.S. military procedure during WWII and all subsequent conflicts, as we shall see.

Conclusions and Lessons Learned

As World War II approached, it was clear that professional services provided by flight surgeons had provided a measurable positive effect upon the safety, health and effectiveness of flying units in peace as well as war. No statistics were available to compare the effects of such care on long-term health of fliers, but improvement in safety and effectiveness could be measured by objective changes in unit statistics, and were corroborated by the contemporaneous judgment of responsible line officers at all levels of command after WWI and at the beginning of WW II. The aeromedical lessons learned may be summarized:

1. Obtain the support of line commanders within the chain of command.

2. Train competent and motivated volunteer medical officers to be flight surgeons.

3. Assign the flight surgeons to primary duty with specific operational flying units.

4. Billet them with their fliers whenever possible.

5. Have them fly with their fliers in the operational environment to assure mutual familiarity with the flying milieu of that time and place, and to share the experiences that engender unit cohesion.

6. Give command support to the necessary aeromedical decisions that assure operational safety and effectiveness.

7. Use periodic *rest* as a powerful counter to flying fatigue in combat situations.

As we review the evolution of aerial warfare and its operational aviation medicine support through the 20th century, we shall see these lessons forgotten, relearned, and reinforced.

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CHAPTER 2

1941 TO 1945: THE U.S. ARMY AIR FORCES IN WORLD WAR II

1940 to 7 December 1941: The Pre-war Years and Pearl Harbor

Lt. Col. Eugen G. Reinartz, the psychiatrist who had trained as a flight surgeon and a pilot in 1919 and who grounded Hap Arnold's crew in Hawaii in 1939, became Commandant of the School of Aviation Medicine on 1 November 1941. Promoted to colonel in the spring of 1942, and to brigadier general in December 1942, Reinartz continued as Commandant until he retired in October 1946. During the war, the School graduated some 5500 U.S. Army Air Forces flight surgeons, as well as a number of foreign officers (Reinartz, 1966). These flight surgeons, most of whom were new to military service, provided aviation medical care to U.S. Army Air Forces fliers around the world under conditions ranging from Arctic blizzards through the heat of the North African deserts to Pacific jungle humidity and endemic diseases.

In a little-noticed but historical moment, under Reinartz's leadership the first African-American medical officers to become flight surgeons attended the School for training in order to serve with the fliers who would come to be known as the Tuskegee Airmen.[19] Reinartz declared that the School would not discriminate against these students, and provided egalitarian messing, quarters and alphabetically seated classroom studies. On one occasion, he explained these policies to the satisfaction of Secretary of State Cordell Hull. The classes went well. All student flight surgeons "proved themselves to be excellent students and we had absolutely not one single, solitary bit of difficulty" with this early integration (Reinartz, 1966).

The momentum of the war effort infused new blood from the world of civilian medicine into professional military medicine. Physicians from academic medical centers entered the U.S. Army Medical Corps both as volunteers and through the draft (e.g., "First Twenty Years," Duke Univ. Bull. 1952; Martin, 1983), bringing new views of aeromedical problems, and new solutions. The influx of academic physicians accustomed to analyzing and reporting their work led to an outpouring of excellent publications detailing their wartime observations and conclusions. Several classic reports of operational aeromedical support to WW II fliers written by these physicians have formed a solid foundation of doctrine for operational flight surgeons in subsequent conflicts. Providing professional post-graduate education for the flight surgeons scattered over the many combat theaters posed a problem,

[19] Col. Vance H. Marchbanks, Jr., USAF MC, was one of these 1941 flight surgeon graduates. He served with distinction as group surgeon for the Tuskegee Airmen in the 332nd Fighter Group in Italy during WW II, and later served in the Korean War and on Okinawa as a flight surgeon. He retired from the USAF in 1964 after a distinguished career and went on to work with moonsuit development for NASA, also serving as a medical monitor for the Mercury and Apollo programs. His research on sickle cell trait in aviators was instrumental in ending the policy that had automatically disqualified persons with this trait from military flying (News of Members, 1961; Hartford courant.ctnow.com/projects/bhistory/marchbanks.html).

so Major General David N.W. Grant, the U.S. Army Air Forces Surgeon General during WW II, authorized publication of *The Air Surgeon's Bulletin.* Distributed to flight surgeons around the world, this bi-monthly periodical described observations and advances in aviation medicine, many written by operational flight surgeons. In addition, the Josiah Macy, Jr. Foundation published and distributed a series of monographs by academicians and collections of essays by operational flight surgeons on their experiences with combat stress reactions.

These two sources are unequalled in the history of combat stress studies as sources of first-hand medical observations of fliers in various aircraft and battle situations. Aircraft of all types flew out of fixed facilities, primitive jungle bases, barely-completed desert airstrips, and runways scratched out of coral on small islands. Some airfields were subject to ground attack, some to air attack, and some to both. Aircrew flew in both intermittent and continual combat operations. Some flew over enemy territory, some over featureless deserts, some over uncharted mountain ranges, some over impenetrable jungles, and some on long missions over the ocean. A review article has discussed the five Macy reports in detail (Jones, 1987), but the reader must consult the entire series for full effect (Grinker & Spiegel, 1943; Hastings et al., 1944; Levy, 1944; Wright, 1945). Many current aeromedical and operational policies derive from the hard-learned lessons of these World War II experiences.

The first U.S. flight surgeon battle casualty in history occurred on the first day of U.S. combat in WWII. First Lieutenant William R. Schick, U.S. Army Medical Corps (MC), 31, graduated from the School of Aviation Medicine as a flight surgeon in November 1941. His course was curtailed by three weeks due to the increasing international tensions. He received orders assigning him to the 38th Reconnaissance Squadron, 19th Bombardment Group at Albuquerque Air Base, New Mexico. Within a week of arriving there, he deployed with his squadron en route to Clark Field in the Philippine Islands.

After landing in San Francisco, the squadron's flight plan included a stop for rest and refueling at Hickam Field, Hawaii. As the twelve B-17s approached the field at 0800 on December 7, 1941, several Japanese Zero fighters attacked the flight. All the B-17s landed intact except for Schick's plane, which was ablaze amidships from magnesium flares ignited by a bullet. With the crew gathered forward in the crippled B-17, the pilot, Capt. Ray Swenson, made a near-perfect landing. However, the impact caused the fire-weakened fuselage to break in half just behind the cockpit. As the wreckage skidded to a stop, the crew jumped out and dashed for safety. A strafing Zero fired at the group and hit Schick several times. He died in surgery later that day, one of the first Americans killed in a war that would claim 405,399 U.S. military lives (McSherry, 1991, 1992; Meiling, 1984; Mullins, 1993; Peyton, 1968, pp. 107-8).[20]

Seven more US Army flight surgeons would die in combat during WW II: Capt. Charles A. Stafford in Java, Capt. John C. Wassell in the British Isles, Capt. Joseph W. Mendoza in Newfoundland, Lt. Burton A. Hall in New Caledonia, Maj. John J. Meany in North Africa,

[20] Two other U.S. military medical officers died that day. Commander Samuel E. Johnson, USN, MC, died along with 1,177 shipmates on the USS Arizona, and Lt. (j.g.) Richard R. Rall, USN, MC, perished on the USS Pennsylvania (McSherry, 1991).

Lt. William C. Craig in Ireland, and Maj. Barney Lihn in France. Forty-four other flight surgeons died in aircraft accidents during the war (Peyton, 1968, p. 108). The names of the 52 U.S. Army flight surgeons who died in combat and in aircraft mishaps during World War II are honored on plaques in the Academic Building of the U.S. Air Force School of Aerospace Medicine at Brooks City-Base in San Antonio, Texas (Appendices A and B).

Captain Sidney Sein, MC, another flight surgeon, was en route to Clark that same day in another B-17. His aircraft landed safely in Hawaii and continued on to the Philippines. A few months later, Sein and fellow flight surgeons Herbert W. Coone and Emmert P. Lentz were captured on Corregidor Island in Manila harbor, endured the Bataan Death March and survived three years in concentration camps in the Philippines. Sein died in 1950 (Meiling, 1984). No further records about Sein are available, but both Coone and Lentz received Silver Stars, Bronze Stars and Purple Hearts for their heroism, and both later achieved the rank of colonel. Coone went on to become a consultant in internal medicine to the USAF Surgeon General and later a flight surgeon for Trans World Airlines. Lentz had a full career in the Air Force, ending his service in 1965 as a medical expert in aerospace safety at Norton Air Force Base (News of Members, 1965).[21]

First Lieutenant Thomas R. White, flight surgeon to a medium bomber squadron, made a historic flight early in the war. Hearing of Lt. Col. James H. ("Jimmy") Doolittle's request for B-25 crews to volunteer for an unspecified secret mission, White, then attached as flight surgeon to the 89th Reconnaissance Squadron, volunteered for the mission. When informed that the only way he could go was as a tail gunner, White earned his way onto a five-man crew by taking twin .50 caliber machine gun turret training and finishing first in his class. He flew as the tailgunner on the 15th of the 16 B-25s to fly off the USS Hornet for the 1942 attack on Tokyo. As planned, his aircraft flew west after the raid, finally ditching off the coast of China. White risked his life by remaining inside the sinking plane until he could retrieve his surgical instruments and medical kit; unfortunately, these were lost when the crew's life raft overturned in rough surf.

As the crew made its way toward Chuchow and safety, they learned that members of another crew were nearby, injured. White elected to stay with and treat the injured crewmembers, which included amputating the infected leg of pilot Capt. Ted W. Lawson.[22] White's concern for his patient led him to draw two pints of his own blood and administer them to Lawson. White and his patients stayed on in a missionary hospital and later made their way to safety. The dangers that White chose to face are clearly defined when one considers that 53 enemy battalions "slashed their way through Chekiang province where most of us had parachuted." These battalions received orders to "thwart the [U.S.] enemy's plans to carry out air raids on the homeland of Japan," and, interpreting them to mean the annihilation of

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[21] Lt. Col. William J. Kennard, MC, the senior flight surgeon in the Philippines, was wounded in the attack on Clark Field in 1941 and was medically evacuated to Australia. He became one of three flight surgeons assigned to the U.S. Army Air Forces in the Southwest Pacific when it was established in March 1942 (Link & Coleman, 1955, p. 726). Dr. Kennard was Executive Secretary of the Aerospace Medical Association from 1959-67.

[22] Lawson lived to write of his experiences in "Thirty Seconds over Tokyo," (1943) later made into a movie starring Van Johnson as Lawson and Spencer Tracy as Doolittle. Stephen McNally portrayed "Doc" White (http://us.imdb.com/Title/0037366).

any Chinese forces in the area, drove 200 miles inland seeking revenge. They searched 20,000 square miles and killed some 250,000 Chinese soldiers and civilians in a three-month campaign (Doolittle, 1991; Lawson, 1943). For his fidelity and heroism, White later received the Silver Star.

European Theater

As the Army Air Forces began their buildup in the European Theater, and especially in England, it soon became clear that the flight surgeon curriculum at the School of Aviation Medicine, though comprehensive concerning physical standards and physiological equipment support, provided inadequate training for flight surgeons preparing to support combat operations. The School faculty had no actual combat support experience, and its curriculum concentrated "99 percent of the efforts...in the direction of the [routine flight] examination," in spite of the fact that this procedure mattered little in day-to-day support of operational flying. Some "65.9% of the Air Force medical officers in the European Theater at the beginning of the war were not qualified to perform their duties" (Link & Coleman, 1955, p. 548). As had happened in WW I (and would happen again in Korea and Vietnam), many flight surgeons embarked for the combat theater immediately after joining the military and completing flight surgeon school, having had no practical experience in dealing with aircrew and with the operational aspects of flight physiology. In addition, many were "not of a type basically suited to become flight surgeons," since the emphasis on their selection mistakenly concentrated "on the idea of the flight surgeon being a 'hail fellow well met,' instead of a professionally qualified individual." Finally, when medical unit commanders in the U.S. were levied for personnel to be assigned abroad, they "'naturally' disposed of the less satisfactory." Since most care of significantly ill fliers was provided by Ground Forces hospitals, flight surgeon training needed to concentrate on sanitation, records, chemical defense, medical response to enemy attack on airfields, and a knowledge of aviation physiology and aircrew protective equipment that would allow the flight surgeon to teach these subjects to aircrew. These trenchant criticisms are cited from a variety of letters and reports written by Colonel Malcolm C. Grow, the Eighth Air Force Surgeon, early in the war (Link & Coleman, 1955, p. 548).[23]

To correct these deficiencies, Grow established the Eighth Air Force Provisional Medical Field Service School in July 1942. This organization, commanded by Major Harry G. Armstrong, was later designated the Eighth Air Force Central Medical Establishment. Armstrong had been in the forefront of aeromedical research since becoming a flight surgeon in 1929, and was the author of a seminal text in the field, one that went into several editions during and after WW II (Armstrong, 1939). In a 1981 interview, Armstrong remembered starting the Establishment. Grow had asked him to be the Deputy Surgeon of the Eighth Air Force. Seeing the many aeromedical problems in England, Armstrong asked if he could set up some training programs. "But I had a problem. I got over there and we didn't have enough trained flight surgeons—those who came through the School of Aviation Medicine [needed] to learn a little extra about taking care of flight crews." Armstrong sent a

[23] Grow was probably the first American physician to fly in combat, as reported above in the chapter on WW I. He went on to become the first Surgeon General of the U.S. Air Force when it became a separate service in 1947 (Armstrong, 1950). The U.S. Air Force Medical Center in Washington, DC is named in his honor.

request to Washington to establish an in-theater training course, but the Surgeon General's Office refused it because it duplicated the School in Texas, and any research that Armstrong might undertake might duplicate the efforts of the Aeromedical Laboratory in Ohio. "So I finally coined this term that had never been used in [the U.S.], Central Medical Establishment, and they said fine, go ahead. Thus, the CME was a place to hide people to teach and to do research, and to get around the bureaucracy " (Temich, 1981).

A recurrent historical experience at the outbreak of hostilities has been the deficiencies of flight surgeon training for combat operations. *The lesson is clear: in war, flight surgeons in command positions should insist that new flight surgeons be trained by colleagues with recent combat experience, and that newly-trained flight surgeons sent to combat theaters be supervised in the field by experienced and motivated senior flight surgeons.* Further, when growing hostilities suggest impending combat operations, assigning authorities should give priority of operational support assignments to senior and experienced flight surgeons, not to junior and inexperienced flight surgeons. As hostilities become more likely, and as conflict begins, aeromedical authorities should not only review initial training of new flight surgeons, but should also provide upgrade information to those in the field.

Many years after WW II, Armstrong wrote of the aeromedical contributions made to air war effectiveness and safety. He gave full credit to Grow although the work was clearly collaborative. First, Grow promulgated the application of the Royal Air Force Air Rescue Service's techniques of recovery of U.S. fliers who crash-landed ("ditched") at sea. This dropped the fatality rate of those who did so from 99.5% to 43% within one year, saving some 2650 lives during the war. Another of Grow's contributions was the development of body armor for Eighth Air Force bomber crews in England. Learning that low-velocity missiles caused 70% of the wounds suffered by these fliers, he supervised the development of light armor for head, torso and thighs, and all U.S. bomber crews had received these "flak suits" by the end of 1943. The aircrew wound rate was reduced by 42%, and the fatality rate of those struck was reduced by 62%. This led to the calculation that, by war's end, flak suits had saved over 2500 airmen from being wounded or killed (Armstrong, 1969; Robinson, 1973, p. 180).

Grow also supported the use of anti-g suits by American fighter pilots. This advance approximately doubled the combat effectiveness of the fighter pilots: the g-suit-equipped pilots shot down 81% more enemy planes per 1000 sorties and 103% more per 10,000 operational hours than those not so equipped, (Armstrong, 1969; Robinson, 1973, p. 190). A questionnaire concerning the effectiveness of anti-g suits yielded evidence of the approval of 83% of the pilots who used them (Aero Med Lab, 1945). Grow, who functioned both as a medical staff officer and as an aeromedical researcher, made signal contributions to the safety, well being and combat effectiveness of "his" aircrew. His work exemplifies the importance of having flight surgeons at all levels of command who are aware in detail of the flying conditions of aircrew under their care.

In June 1942, in an effort to aid morale, the Commanding General of the Army Air Forces, Gen. Henry H. ("Hap") Arnold, declared it "mandatory that every flight surgeon fly with his personnel." Arnold maintained that flight surgeons should fly with "each and every pilot,"

be able to speak intelligently with aircrew, and show a "definite interest in flying and things flying" (Link & Coleman, 1955, p. 665). The "mandatory" aspect of this message met with varied responses in the European Theater of Operations. The Eighth Air Force Commanding General, Carl A. ("Tooey") Spaatz and his Command Surgeon, Col. Grow, endorsed the idea heartily.

> During 1943, following the endorsement of the policy by the Commanding General of the Army Air Forces, 53 [Eighth Air Force] flight surgeons made a total of 91 operational missions to all types of targets found over enemy territory without loss or serious injury to any of the participants... The experience acquired by the flight surgeons on these missions was regarded as of considerable value to them in their work. The problems associated with night vision, lighting equipment for night operations, oxygen and protective flying equipment were more thoroughly comprehended thereafter. Of greater importance, however, was the fact that the documented willingness of flight surgeons to share the hazards of combat missions had a "stimulating effect on the morale of the combat crews." Said one crew member, "I do not mind discussing my problems with the Doc—he has been over there too and knows my language." (Grow, cited in Link & Coleman, 1955, pp. 665-6.)

Once again, the highest line and medical authorities endorsed the policy of flight surgeons flying with their aircrews, and provided evidence of the benefits of this practice in unequivocal language.

In WW II, flight surgeons and their aviation psychiatric colleagues faced the same problem of combat fatigue in aviators that had concerned their WW I predecessors under the name of aeroneurosis. As WW II progressed in theaters around the world, a pattern emerged that wove together the strands of combat stress, designated combat tours, periodic rest and recreation programs ("R&R"), and the difficulty of knowing when to urge a flier to continue flying and when to ground him (Robinson, 1973, pp. 182ff). We will examine flight surgeon roles in these matters in the European theater of operations, and then in the other geographic theaters of the war.[24]

Former academic psychiatrists who joined the Army published their observations of combat stress reactions in aviators. The Central Medical Establishment, which expanded to support both the Eighth and Ninth Air Forces in England, provided notable advances in this field. Bond's "The Love and Fear of Flying" (1952) and Grinker & Spiegel's "Men Under Stress" (1945) should be required reading for any flight surgeon seriously studying combat stress in aviators. Such work represented the first time most of these psychiatrist/authors had dealt, not with civilian psychiatric patients, but with persons who had been demonstrably in good previous mental health, and who had become symptomatic for specific and immediate reasons rather than for reasons deriving from childhood influences. The advances of the work of these psychiatrists reached far beyond aviation medicine, providing major milestones in the progress of general clinical psychiatry after the war.[25]

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[24] These topics involved areas outside flight surgeon jurisdiction, including selection processes, command policies, and decisions about when to invoke administrative and disciplinary sanctions. For scholarly reviews of such matters, the reader is referred to a comparison of British and American policies (Wells, 1995) and of Canadian policies (English, 1996). See also Stafford-Clark (1949) and Symonds (1943).

[25] For a detailed first-hand account and discussion of the development and application of this philosophy, see Anderson (1973) and Bond (1973).

Grinker and Spiegel, who began their work in the Mediterranean Theater and then moved to England, make a basic point clearly in the first paragraph of their Introduction:

> "The stress of war tries men as no other test that they have encountered in civilian life. Like a crucial experiment, it exposes the underlying physiological and psychological mechanisms of the human being. Cruel, destructive and wasteful though such an experiment may be, exceedingly valuable lessons can be learned from it regarding the methods by which men adapt themselves to all forms of stress, either in war or peace. In truth, it is a moot question whether, in the peace which will follow the present conflict, the degree of stress on the average individual will be much less than that imposed by the war. Because of the current and future necessity of large populations throughout the world to face a difficult reality, never in the study of human behavior has it been so important to understand the psychological mechanisms of "normal" individuals in situations of stress."(1945, p. vii)

Later flight surgeons condensed this point into the axiom, "Everyone has his breaking point," words that underlie modern approaches to this enduring reality of combat flying (Mullins, 1973).

The matter of specified-length combat tours for fliers concerned senior staff flight surgeons from the beginning of the conflict. Grow addressed the problem in 1942 as a matter concerning morale and operational efficiency. The estimated loss of 5% of Eighth Air Force bomber crews flying each mission indicated a theoretical average life expectancy of 20 missions, a fact well known to the fliers themselves. Line commanders ignored Col. Grow's recommendation for a 15-mission tour, and subsequent aircrew attrition, along with lack of replacements, resulted in low morale with mental effects including flying fatigue and combat exhaustion. The Central Medical Board recommended a definite and fixed combat tour, and Generals "Tooey" Spaatz, Ira C. Eaker and Jimmy Doolittle endorsed a policy that set a limit of 25 missions for bomber crews and 150 missions or 2000 hours for fighter pilots. This policy also directed the award of a Distinguished Flying Cross to all aircrew completing a combat tour (Link & Coleman, 1955, pp. 661, 670-1).[26] About 75% of the aviators who completed their tours returned to the U.S., while the rest remained in Europe as instructors or staff assistants (Link & Coleman, 1955, p. 661). Other operational units established tour parameters based on the same principles as those put into operation under Grow's management. The principle of designating specific tours for combat aviators eventually extended through combat flying commands around the world (Link & Coleman, 1955, pp. 852 ff, 962ff). General Curtis LeMay, who would later command the Strategic Air Command and then become the Air Force Chief of Staff, recommended this policy to the Air Staff in Washington and an unnamed "chief medical advisor" stated, "I believe I can see a beginning of some appreciation for the 'Human element' in operational planning" (Link & Coleman, 1955, p. 963). The policy of specified combat tours for fliers continues to this day.

Modern commanders should not forget the circumstances that led their illustrious predecessors to establish such policies, and modern flight surgeons should remind any commanders who do forget. Aircrew can and will perform the simple calculations that

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[26] The "combat tour" differed according to theater, numbered air force, aircraft type, phase of the war and degree of enemy opposition, and so one encounters varying policies in official reports. No overarching general rule was ever defined, but the various policies seem to have been intended to give the involved aircrew a greater-than-even chance of surviving and going home.

transform daily loss rates into likely personal survival times. Such information, accurate or not, will certainly affect morale and influence the pattern of combat stress reactions. For example, the 1st Bombardment Division Surgeon reported in December 1944 that instituting specified combat tours reduced psychiatric casualties, and a greater number of men were completing their tours and returning to the U.S. After combat tours were established, fewer fliers were killed or wounded in action, a fact that may have derived from less fatigue and better flying performance. An extensive analysis of policies concerning time off and R&R programs accompanies these data in Link & Coleman (1955, pp. 662ff). Anyone studying the subject should become familiar with this historical background, based on trial and error with large numbers of men in intense combat. The more intense the combat, the more combat fatigue will result. The beneficial effects of planned rest periods are clear and immediate.

Malcolm Grow, Harry Armstrong and Otis Benson served with distinction as flight surgeon-scientists at the Aero Medical Laboratory at Wright-Patterson Field before the war, and assumed overseas positions of responsibility in which they served until the end of the war. These men and their colleagues can only be briefly mentioned here, but the interested reader may find an extensive review of their work in the reference cited (Link & Coleman, 1955).

By opening an aeromedical training facility (the Central Medical Establishment) in England and a Neuropsychiatric Treatment Center in the Mediterranean Theater, these distinguished senior flight surgeons picked up exactly where Wilmer and his staff had left off when they closed their Medical Research Laboratory at Issoudun at the end of WW I (Kaplan, 1945; Wilmer, 1920, 1935). Such flight surgeons exemplify the finest professional traditions through the quality of their service in active combat operational arenas. *This lesson in the value of in-theater teaching and supervision of operational combat aerospace medicine programs by seasoned veteran flight surgeons may prove useful should the U.S. again undertake prolonged combat operations in one location.*

Mediterranean Theater

The Army Aviation Service in Europe flew out of somewhat spartan facilities during World War I. However, deployed American Air Forces in WW II faced the new challenge of caring for fliers in geographically remote and primitive base locations, especially when those bases were subject to enemy attack. Living conditions in the Mediterranean Theater were extremely rigorous, and fixed quarters were usually unavailable. Troops slept in tents when they could be obtained, and under shelter halves, in hangers, under aircraft wings, and even in aircraft if necessary. Bathing facilities were scarce, the supply system uncertain, and the weather foul. "Air Force troops, accustomed to the airdrome life of the United States and the United Kingdom, and relatively poorly conditioned and ill-equipped to cope with the situation which now faced them, were wretched" (Link & Coleman, 1955, pp. 427ff; Moore, 1999). Flight surgeons had to cope not only with the usual diseases of fliers, but also with sanitary problems of all sorts: water supplies, malaria and other vector-borne diseases, waste disposal, and epidemic venereal disease. In addition, the forward operational bases were subject to periodic German air attacks.

As Commander first of the Twelfth and later the Fifteen Air Forces in the Mediterranean Theater, Brig. Gen. Jimmy Doolittle supported aeromedical efforts throughout the war in the same spirit as his support of Dr. White's accompanying the Tokyo raiders. Operational fatigue had become a critical factor, and the institution of combat tours, discussed above, proved a partial solution. The work of Drs. Roy R. Grinker, John S. Spiegel and their colleagues graphically depicts these living conditions, and the work of flight surgeons and mental health specialists in countering them (Grinker & Spiel, 1945). Col. Otis O. Benson, now Doolittle's Surgeon, took note of these developments and developed a specific Neuropsychiatric Department within the Twelfth Air Force that provided a model for enlightened handling of fliers worn out by combat operations. Doolittle endorsed this new principle of medical rather than administrative management of combat fatigue in fliers:

> Colonel [Otis O.] Benson (who was regular A.F. but a scientist from the old Aero-Medical facility) was very sympathetic towards the psychological aspects of aviation medicine, did a most marvelous thing. He persuaded Jimmy Doolittle to allow us medical people to set up a new system for handling of combat personnel who were having difficulties flying. Instead of going through command channels, it became mandatory that they go through medical channels [emphases in the original], and that the disposition of the individual case be carried out by the Surgeon's office, not by command. Jimmy Doolittle deserves a lot of credit for allowing this unusual arrangement. I never knew, however, whether, in the midst of organizing a new Air Force, he really understood what a profound change this was... Then later, after we had moved to Southern Italy General Nathan Twining, (later chairman of the Joint Chiefs) replaced Doolittle as Commander of the 15th. Much to his credit, he backed us whenever we had conflicts with the Command, as you can easily understand we had from time to time. As I described in my monograph [25], this was partly due to the fact that he could trust us to keep the men on combat flying status as long as possible and only ground them when they could no longer function adequately" (Norman A. Levy, MD, former 12th AF psychiatrist, personal communication to D.R. Jones, 1985).

The "lessons learned" by theater flight surgeons were disseminated throughout the theater through in-house publications, consultant visits and occasional seminars. Their innovations included:

1. Standard aeromedical policies related to the disposition of mental health problems in fliers and in non-fliers
2. Instruction of flight surgeons in psychiatric matters, and supervision of treatment of individual fliers
3. Consultation when duty changes seemed advisable
4. Participation of mental health consultants in Medical Disposition Boards
5. Observations and recommendations concerning general morale (Link & Coleman, 1955, p. 496)

From an organizational viewpoint, squadron flight surgeons tended to be gathered into Wing and Group medical facilities for additional duties under the supervision of Wing and Group surgeons. Air Force historians Mae Mills Link and Herbert A. Coleman provide detailed information about the further development of medical and aeromedical support to Twelfth and Fifteenth Air Force operations in North Africa, Sicily and Italy (Link & Coleman, 1955, pp. 438-50). These efforts may be summarized partly as trial and error, and partly as learning the value of flexibility in applying doctrine to the realities of combat operations in an ever-changing environment.

The 6-man planning board for the invasion of North Africa, included Generals Hoyt Vandenberg and Lauris Norstad. Major William F. Cook, MC, the medical member of the board, was solely responsible for developing a medical strategy for this massive operation. Assuming that liaison would be poor and transportation scarce immediately after the North Africa landing, Cook, under the direction of Col. Grow, designed a haversack with 30 pounds of essential medical supplies to be carried by medical personnel, one by each physician and one for every three enlisted medical personnel. Ambulances were to be loaded with splints, crash response kits, blankets and blood plasma. These plans proved valuable and effective, and would be reflected in later operations in the Pacific Theater. Cook became the Deputy Surgeon and later the Surgeon for the Twelfth Air Force, serving in Tunisia, Sicily, Italy, and Southern France (Link & Coleman, 1955, pp. 420ff, 948; News of Members, 1964 & 1966).

Flight surgeon Samuel T. Moore, a first lieutenant, saw these plans for Operation Torch become reality when he "hit the beach" of the Moroccan coast on 8 November 1942. Along with the other men in his P-39 squadron, he stood by all day on his troopship while others landed. His ship, the *USS Anne Arundel,* carried 50,000 gallons of high octane gasoline as well as bombs and torpedoes among its cargo. This highly flammable vessel drove away a nearby enemy submarine with 20-mm cannon fire with the troops still on board. Finally Moore climbed into an invasion barge (his medical commander missed a step and fell, cracking several ribs), moved ashore, marched up the beach for three hours, dug in, and "prepared with tommy guns and pistols for an expected counterattack." Moore wrote that his total field gear weighed "60-plus" pounds, so Cook did well to keep his planned medical gear light (Moore, 1999, pp. 58, 68ff).

Moore's experiences on what may have been the first combat deployment of a fighter squadron flight surgeon provide an enduring Lesson Learned. *Whether deploying to new airfields or supporting combat operations, flight surgeons should plan to be medically self-sufficient for at least a week after arrival in a combat theater.* Flight surgeons assigned to new bases in the Pacific Theater would reinforce this lesson, even late in the war, and flight surgeons in Vietnam and in Southwest Asia had similar experiences.

As World War II continued, the effects of prolonged air combat operational exposures and losses began to affect fliers in ways that resembled the effects of World War I. Now, however, flight surgeons were present from the start to observe these effects. Captain Robert Rehm carried his interest in combat stress further than any flight surgeon before or since, providing an example of what may be learned by having flight surgeons fly with their units. After serving for a year as flight surgeon to a heavy bomber squadron in Italy (probably B-24s), he realized that he had little understanding of the dynamics of combat fatigue, and so he flew a complete 50-mission tour with a crew in his unit. Rehm may be the only non-aircrew flight surgeon in any war to have flown such a tour and reported upon his experiences.[27] His published observations, made upon himself and other fliers, noted a

[27] A few pilot-physicians served in WW II, but apparently functioned mainly as pilots. The Air Surgeon thought they should be regarded as medical professionals, but the Chief of Staff, General Arnold, "noted that these doctors had been trained as members of the crew, and that it would be much harder to replace them than

progression of psychological factors occurring in three segments: the first 10 missions, the middle 30, and the last 10 (Rehm, 1945). He noted that anxiety was highest during the first 10 missions, especially when crews came under heavy anti-aircraft fire, had wounded crewmembers aboard, or witnessed the loss of other aircraft. In dealing with frightened aircrew, he found it necessary to adopt a firm attitude and *not* leave the decision to fly up to the aviator, explaining that the flier was not ill and must continue to fly. Although Rehm does not mention it, his own flying must have served as an example to the aircrew; he spoke with the authority of first-hand knowledge.

After the first 10 missions, Rehm found that his own (and others') excitement diminished as familiarity increased. He now accepted formerly novel situations as routine, and saw that crewmembers became more homogenous and cooperative. He also felt an almost irrational faith in the abilities of his pilot, noting that this was quite common in the squadron: to his own crew: each pilot "stands as a tribute to experience and a symbol of their safety." Rehm became able to relax during missions, except when actually under fire.

Late in his tour, Rehm noted growing hypochondriasis, along with increased use of tobacco and alcohol. He became insomniac, irritable, nervous and temperamental. He had "little zest for the squadron activities. My appetite decreased materially, and I noticed that during the past two and a half months my weight had dropped from 178 to 156 pounds... However, throughout this entire period, the interest and encouragement of the men in the squadron and group spurred me on to greater efforts than before" (Rehm, 1945). The Josiah Macy, Jr. Foundation disseminated Rehm's description of his accomplishments and unparalleled observations to flight surgeons around the world (Jones, 1987).

Another lesson learned was to delegate the management of flight surgeon status from the Air Surgeon, Army Air Forces to the theater surgeon, thus allowing for rapid response to local needs. Flight surgeons were encouraged to fly on a few combat missions for their own professional experience, and to increase their acceptance within their squadrons. Specific policies in this regard were left to the discretion of the group commanders within the Twelfth Air Force, and to the Command Surgeon of the Fifteenth Air Force. Personnel policies concerning assignment, supervision and promotion of flight surgeons affected flight surgeon performance in their combat support roles, in the Mediterranean Theater and in others. Some non-aeromedically-trained physicians were assigned to Mediterranean Theater flying units early in the war, as had happened in WW I (Kaplan, 1945; Wilmer, 1920). These men were observed in the field, and those whose personalities, demonstrated ability and seniority warranted advancement were selected to rotate back to the School of Aviation Medicine in Texas for formal flight surgeon training: 87 did so in 1943, 30 in 1944, and 25 in 1945. These flight surgeons were then reallocated to Mediterranean Theater units upon their graduation (Link & Coleman, 1955, p. 453).

As new flight surgeons acquired experience and seniority, flight surgeon promotion policies became a morale issue. Few opportunities existed for upward movement within the operational flight surgeon career field, and some abuses resulted from within-unit

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it would be to go to civilian life and procure [draft] other doctors" (Link & Coleman, 1955, p. 958). The authors are unaware of any reports by these pilot-physicians about their experiences or observations.

promotions by their local commanders of flight surgeons for merit and seniority. A further deterrent to promotion of medical officers in the theater was the policy of providing replacements in rank and grade from outside the organization, or indeed from outside the theater (Link & Coleman, 1955, p. 454). These problems with assignment of inexperienced flight surgeons into mid-level command positions would reappear in the Vietnam conflict.

China-Burma-India Theater

The U.S. and Japan fought in the China-Burma-India (CBI) Theater with limited human and material resources, uncertain supplies and low priority. Perhaps more than in other theaters, improvisation by flight surgeons and their staff members was the order of the day. Care for the sick and wounded was the best possible, given the limitations of manpower and medical materiel. Flight surgeons and their technicians stood ready to fly to stricken areas, parachuting in when necessary and administering whatever aid they could. Aeromedical evacuation developed as necessity demanded, and under rigorous circumstances. Medical personnel improvised field ambulances from standard Dodge trucks that were taken apart for air transport on C-46 aircraft and reassembled at remote locations (Link & Coleman, 1955, pp. 906-7). One may fairly summarize the situation by stating that the new flight surgeons had little preparation for the rigors of their duties in this theater.

As in the Mediterranean Theater, flight surgeons had to learn anew all the classic lessons of field sanitation. Forward operational flying fields in the CBI Theater were appallingly primitive, especially during the early period of the war. One such base at Chabua, India was a "dread and dismal place where dysentery was frequent and malaria certain, where haggard, sweating men dragged their feverish bodies through the day, ate execrable food, and shivered through nights often made unbearable by mosquitoes" (Severeid, cited in Link & Coleman, 1955, p. 877). War correspondent Eric Severeid and others took off from such a site in August 1943 for a C-46 flight across Burma. An hour later, he was parachuting into the jungle with the crew and the rest of his party as the plane crashed. Another aircraft spotted them and dropped some supplies, and toward twilight, a third plane appeared. Three men parachuted to join the survivors: Lt. Col. Don Flickinger, the Wing Surgeon of the CBI Wing of the Air Transport Command, and two medical technicians, Sgt. Harold Passey and Cpl. William MacKenzie. It was the first jump for all three. Flickinger assumed command of the party, provided care for the ill and the injured during the next month, and led them out of the jungle. Because they had jumped without orders, some debate ensued at headquarters as to whether Flickinger and his men deserved medals or courts-martial, but they finally received the awards.

The need for flight surgeons with parachute training was becoming clearly defined in the CBI Theater, and other flight surgeons later carried out search and rescue missions under more orderly conditions (Link & Coleman, 1955, pp. 877ff). Maj Ormand C. Julian, a member of Flickinger's staff, jumped into the jungle with small surgical teams four times to give medical aid, each time bringing the patients out on litters. Major Julian also worked with Dr. Gordon Seagrave, the famous "Burma Surgeon."[28] The early informal flight

[28] Gordon S. Seagrave, M.D., was a missionary in Burma when the war began. He accepted a military commission and became a staff surgeon with Sixth Army commander General Joseph "Vinegar Joe" Stillwell

surgeon use of aircraft to rescue, treat and carry acute casualties was later organized into the 803rd Air Evacuation Squadron, with flight surgeon-ophthalmologist Major Morris Kaplan as its commander.[29] One flight surgeon, Major Ralph L. Dewsnup, was killed while flying in a search and rescue aircraft in India. Another, flight surgeon-plastic surgeon Capt. John J. Duncan, was wounded by a mortar shell that killed a Chinese patient who was being loaded onto an aircraft at Myitkyina, Burma the day after Merrill's Marauders had captured this vital base (Link & Coleman, 1955, p. 880).

The efforts of these flight surgeons are part of the histories of Merrill's Marauders and Lt. Col. Philip Cochran's 1st Air Commando Group. These units received aeromedical support from five flight surgeons commanded by Maj Robert C. Page, MC, and from other flight surgeons in the Tenth Air Force. Maj. Page and a Capt Taylor (first name unknown) flew with Col. Cochran and Gen. Orde Wingate in tests of glider night landings, and flight surgeons Murphy, Tulloch (both otherwise unidentified) and Enloe[30] flew in combat glider landings. Maj. Page wrote of the importance of flight surgeons working with locally hospitalized unit members, reducing hospital time and "saving face" by quickly returning fatigued fliers to duty (Link & Coleman, pp. 877-80). These benefits illustrate the principles of *proximity, immediacy* and *expectancy* used today in combat psychiatry (Jones, 1995).

Few aeromedical records of flight surgeon work in this theater have been published. The information that has become available emphasizes the need for preventive medicine and public health measures, careful attention to aircrew fatigue, improvisation to meet unforeseen circumstances, and close coordination between line and medical commanders. None of these lessons was unique to the CBI Theater, but nowhere else were they so clearly demonstrated. Perhaps this occurred because the theater involved fewer aircrew and flight surgeons than the others, and so individual contributions could be more easily identified. The lessons learned from the irregular nature of flight surgeon support to CBI air operations would be learned again in the early stages of the air war in Vietnam 20 years later.

Pacific Theater

The Pacific Theater was a huge operation involving seven numbered Air Forces.[31] Operational flight surgeons mainly supported tactical operations, most flown from small airstrips in jungle or isolated island locations. Many of the facilities were either captured

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during the Army's epic retreat through Burma. Seagrave also provided medical care for Col. Claire Chennault's China Volunteer Group, the "Flying Tigers." Seagrave's two books became WW II classics (1943, 1946).

[29] Though the present study is limited to flight surgeons, any mention of this unit must include an acknowledgment of the heroic efforts and contributions of its flight nurses and medical technicians. Their service was truly above and beyond the call of duty.

[30] Dr. Cortez F. Enloe, Jr. was a flight surgeon with Lord Louis Mountbatten's Air Commandos in the CBI Theater. He went on to participate in the post-war evaluation of strategic bombing in Europe, and received the Legion of Merit, Bronze Star and Air Medal. He became a renowned yachtsman in his later years (News of Members, 1968).

[31] The air war in the Pacific and the Far East was so massive and diverse that this report can only sketch the outlines of its flight surgeon support. The interested reader may wish to read the detailed and scholarly review presented in "Medical Support of the Army Air Forces in World War II" (Link & Coleman, 1955, pp. 725-824).

from the Japanese or quickly scratched out on coral atolls. "Island-hopping" army operations meant that many units had to leave such a base as soon as they had begun to make it livable, repeating the process at their next location. Major exceptions to this pattern of flight surgeon support occurred with the development of larger and more permanent facilities in support of the aeromedical evacuation system[32] and the strategic long-range B-29 bomber program late in the war.

The Air Forces had no dedicated medical facil ties except island dispensaries, although some of these grew to include traditional hospital functions. As in the Mediterranean Theater, many flying units deployed early in the war without flight surgeons, and medical officers without aviation medicine training had to furnish aeromedical support. For example, in April 1943, the Thirteenth Air Force had 25 flight surgeons assigned against 40 billets. Although such shortages gradually improved, timely rotation of experienced flight surgeons continued to be a problem throughout the war. Area central medical establishments were organized at Guadalcanal; Nadzab, New Guinea; Auckland, New Zealand and, late in the war, Clark Field on Luzon in the Philippine Islands. These establishments also served as replacement pools for ill or exhausted unit flight surgeons, although the Air Forces never completely solved the problem of keeping flight surgeon assignments filled (Link & Coleman, 1955, p. 731).

One flight surgeon in the South Pacific described having to wait almost two months for a replacement after being almost crippled by fungus infections of hands and feet. During his sojourn, he experimented with iontophoretic treatment of skin fungus diseases, using copper sulfate and potassium permanganate. He finally had to be medically evacuated back to the U.S. (E.W. Shafer, M.D., unpublished diary, 1944).[33] Matters of stress, crew rest, combat tours and combat fatigue were crucial here, as in other theaters. Some units handled the matter of crew rest somewhat informally.

> "Today the Col. [William C. Sams, 71st Tactical Reconnaissance Group commander] blew in, [I] was rather taken aback to have Gordon [Maj. Donald M. Gordon, 82nd Squadron commander] hand me the list of pilot's individual flying time and tell me to pick out the men who should go on leave. The Col. wants them to begin on the 29th [of January 1944]. There will be 5 away for a week plus travel time and 24 hours before they are due back for the next 5 to go... I picked 10 men with the most # of missions and hours. The highest was 63 missions and 98 hours and the lowest was 49 missions and 79 hours. Fortunately, all those beginning to show the strain are in this group of ten. I suggested and it was accepted, that the ten decide which group of 5 they would rather be in. This gives the fellows the opportunity to spend their leave with their closest friends. If the first bunch that goes to Sydney [Australia] can rent an apartment, then the following groups can take over. The three or four starting to show pilot fatigue or "operational stress" evidence loss of weight, sallow complexion, nervousness, appetite poor, sleep not good, one has nightmares. They're not quite as eager to fly and become irritated

[32] Development of the aeromedical evacuation system is an important part of the aeromedical support to the flying mission, but has been omitted from this study because it involves care of sick and wounded service members rather than specific care furnished by flight surgeons to fliers.

[33] Mike Moffitt, a squadron member, transcribed excerpts from the diary of Captain Earl W. Shafer, flight surgeon of the 82nd Squadron, 71st Tactical Reconnaissance Group, 91st Reconnaissance Wing, Fifth Air Force, before Dr. Shafer's death. Col (Ret.) Warren L. Sparks, who commanded the 71st during WW II, kindly sent the complete set of excerpts to DRJ.

very easily. Some of them smoke excessively. A couple of wives are due to have babies back home and this is an added worry." (Shafer, cited in Wiley, 1994.)[34]

Along with stressors of direct air-to-air combat, Shafer describes miserably primitive living conditions, frequent unit moves to newly occupied islands, decomposing enemy bodies left on captured airfields, occasional attacks by stranded enemy soldiers, enemy air attacks, snakes, scorpions, boredom, poor food, lack of refrigeration, and casualties not only from enemy action, but also from pilot error accidents. One of the most regrettable causes of pilots' deaths was their penchant for doing victory rolls over the field at low altitudes: one crashed after doing nine straight rolls.

Shafer omitted alcohol from his list of stressors. General Douglas McArthur had forbidden alcohol in this theater, and Shafer had earlier commented upon the number of homemade stills in the unit. One of the few approved sources of alcohol for aircrew was the "mission whiskey" handed out by flight surgeons for relaxation: two ounces after every combat mission. This policy was modified later because some fighter pilots were flying three to four missions per day (Link & Coleman, 1955, p. 838).

In addition to primitive living conditions and exotic diseases, flight surgeons in the far-flung Pacific Air Forces' squadrons faced morale and mental health problems never before encountered. As formal R&R programs evolved in the theater, "the presence of flight surgeons of outstanding caliber in such centers was found to be absolutely essential" (Link & Coleman, 1955, p. 734), and such flight surgeons were assigned by means of reorganization of various central medical establishments.

Long over-water flights to and from combat meant that medium and heavy bombers with wounded aircrew aboard had to furnish their own medical aid for hours, and so some flight surgeons taught their squadrons how to use antibiotic powders and to administer intravenous fluids in flight, giving demonstrations with crewmembers practicing venipunctures on each other. Capt. Lowell L. Eddy, a flight surgeon of the 396th Squadron, 41st Bomb Group, Seventh Air Force on Tarawa Island, may have been the first to do so, in late 1943. Before his B-25 squadron deployed from California, he decided:

...that the crews must learn to mix and administer the plasma [carried dry, with distilled water and syringes that Dr. Eddy obtained by personal visits to U.S. Navy hospital ships and placed aboard the aircraft in kits]. He proceeded to organize and conduct classes and actually had each crewmember do the procedure. A few days later I [the pilot, Col. Mirzaoff] had to administer plasma to...our navigator [Lt. Doyle], who was severely wounded. He survived the 3-hour flight back to the base, [and] was then evacuated to Hawaii, where he made a full recovery. The incident was published in all Associated Press and United Press newspapers, as well as the medical section of "Time" magazine. Dr. Eddy flew as an observer on a few combat missions in B-25s, but his usual post was in a crash ambulance by the runway, awaiting returning aircraft with wounded aboard. In one 3-week period the unit lost a third of its B-25 crewmembers to enemy fire, usually patterned flak fired over the small islands under attack. (Personal communications to DRJ by August "Gus" Mirzaoff, Colonel, USAF, (Ret.), 15 October 1999 and 15 October 2000, and by Lowell L. Eddy, M.D., 15 October 2000).

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[34] These aircrew members flew L-5, P-38, P-39, B-24, B-25, B-26 and A-20 aircraft. The privately printed squadron memoirs included some of Dr. Shafer's observations in the larger context of the war as seen by the pilots (Wiley, 1994).

Newly arriving aircrew underwent essential survival and medical first aid training, including giving intravenous plasma to wounded crewmates and learning the principles of controlling tropical disorders. Other aeromedical problems included difficulty in returning fliers who had been hospitalized in facilities distant from their home bases back to their units: some waited as long as three weeks for transportation. Cooperation between flight surgeons and their non-flying colleagues varied. Sometimes the rapport was excellent, and at other times, the hospital physicians allowed the flight surgeons to see their fliers only as visitors (Link & Coleman, 1955, pp. 744ff). Medical statistics on fliers were so poor that at one point the Surgeon of the Far East Air Force estimated them to be only 38% correct.

Fliers in the Pacific Theater could compare their combat roles directly with their counterparts in the other services, and negative comparisons affected morale. The Army Air Forces in the Pacific handled the matter of combat tours differently from the Navy (18 month tours) and the Marines (14-month tours): the Army had no rotation policy at all during the first part of the war. The differences in these approaches were not lost on the Army pilots or on their flight surgeons, who repeatedly recommended that definite goals be set, and that R&R centers be established. Being unable to work toward a definite personal goal detracted from pilot morale, especially in remote and unpleasant bases, and operational and combat fatigue syndromes were commonplace (Link & Coleman, 1955, pp. 847ff).

Different numbered air forces dealt with this matter in different ways as the war progressed, and flight surgeon reports helped to identify the most effective programs. "The consensus was that rest leaves of 9 days' duration proved to be the most beneficial for aircrew personnel. Leaves of shorter duration failed to take full advantage of the benefits derived; whereas, after leaves of longer periods than 9 days, flying personnel exhibited a reluctance to return to combat. The majority of personnel at the completion of 9 days' leave were anxious to return to their units and resume combat activity" (Link & Coleman, 1955, p. 858). Flight surgeons assigned to the R&R centers interviewed the fliers and provided medical care and counseling when necessary. Men haggard from jungle base living conditions gained an average of 11 pounds during their 9-day rest leave at the center in Auckland, New Zealand. As the various numbered air forces improved their programs, their non-effectiveness rates also decreased. In 1943, the Thirteenth Air Force Surgeon reported that the days lost per 100 fliers per month for "flying fatigue" alone dropped from 29.6 to 3.9 over a five-month period as R&R programs were instituted, combat tours were established, and fatigued aircrew were replaced and rotated home (Link & Coleman, 1955, p. 856).

One lesson clearly demonstrable in the histories of the Army Air Forces operating in the various Pacific and Far Eastern theaters is the value of well-trained flight surgeons in identifying problems and recommending solutions. Flight surgeons had to establish and monitor matters of sanitation, nutrition, preventive medicine and public health far removed from topics ordinarily studied in the United States. Throughout the war, more man-days were lost from diseases and from symptoms arising from matters of morale and mental health than from enemy action. Although establishment of R&R programs was not the responsibility of the flight surgeons, medical observations, reports and recommendations

about the health and morale of fliers formed the basis upon which commanders took corrective actions.

Very Long Range Bombers: the B-29 Program

The flight surgeons who worked in the B-29 development and deployment programs, which began in 1943, deserve special attention. These flight surgeons were involved in these programs from the beginning, and benefited from the accumulated experiences of their colleagues in the early years of the war. Col. Robert J. Benford, 58th Wing (H) surgeon,[35] was the first flight surgeon to fly in the B-29, a test flight at Marietta, Georgia in July 1943. In his capacity as wing surgeon, and later as the XX (Twentieth) Bomber Command Surgeon, he and other experienced flight surgeons consulted on development of the personal equipment and the training in its use in this first bomber to have a pressurized crew compartment. These flight surgeons undertook operational research concerning rapid or explosive decompression in flight, certain to occur when enemy fire pierced a pressurized cabin. Aircrew training in flight physiology also included such operationally-learned lessons as administering advanced first aid in flight: two members of each crew learned how to suppress hemorrhage, give blood plasma intravenously, and administer morphine during the long hours that might pass between enemy action and return to base. Other innovations included devising a computer for determination of existing oxygen supply in flight, developing flight suits with zippered openings to facilitate first aid, and designing flak suits for B-29 aircrew. One flight surgeon, Captain Dale D. Hickson, invented a 9-pound folding aluminum litter that could be slid through the pressurized crawl tube connecting the forward B-29 cabin to the bunk area in its midsection. Two other flight surgeons, Major D. M. Green and Captain Edward F. Hellwig, developed litters that could be slung from empty bomb rack supports: up to 16 patients could be transported in this manner if necessary (Link & Coleman, 1955, pp. 927-8).

Col. Harold H. Twitchell, Second Air Force Surgeon, was appointed the XXI Bomber Command Surgeon in July 1944. Within 24 hours of his appointment, he was underway from the CBI Theater to Saipan Island for a preliminary health study of the area to which the B-29s would soon deploy. The first aircraft landed there in October:

> When I came out with the Advance Echelon I was the only...Medical Department personnel [sic] here...The only construction in our area was one...500-man mess (to feed 1500; 3 times a day); latrines *not* constructed on proper sanitary principles and shower baths with soakage pits that would not absorb the water. Every one from Colonel to Private put on their working clothes and constructed tent frames, dug soakage pits and corrected sanitation of latrines. Attached personnel arrived faster than houses could be built. No medical facilities were available. With borrowed Medical Chests, the Staff Medical Section furnished medical care, treating about 80 cases a day. Mostly minor injuries (Link & Coleman, 1955, p. 949).

Twitchell's experience was later reflected in a recommendation by Lt. Col. Jack Bollerud, who succeeded Benford as the XX Bomber Command Surgeon in December 1944, that:

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[35] Dr. Benford, an active early flight surgeon, later wrote the definitive early history of the Aero Medical Association, now the Aerospace Medical Association (1955).

> [All deploying] tactical units...should have in their possession a 30- to 60-day level of expendable medical supplies...shipped on the passenger transport that carried the troops, and not shipped via cargo vessels. There seems to be a common assumption that medical supplies are in the theater awaiting the arrival of an organization at their destination. We have found this not to be true, and have been able to sustain medical care in a number of instances only because we have carried a certain amount of medical supplies with each unit. I cannot too strongly recommend that all Air Force organizations departing the States carry with them a certain amount of expendable materials (Line & Coleman, 1955, p. 948).

These and other flight surgeons participated in all aspects of the introduction of B-29s into the Pacific Theater's 20th Air Force, and flight surgeons flew on three of the first five B-29 combat missions. Further, flight surgeons in the combat theaters transmitted the lessons they had learned back to U.S. training centers for dissemination to new crews. Bollerud wrote in December 1944 that, "Our flight surgeons are doing a great deal of flying. Approximately 50% of the flight surgeons 'go forward' [deploy with their units] each time a mission is flown off our forward bases. Several have been on combat missions. They have been doing an excellent job." He went on to say that several line commanders had commented that they had the best group of doctors they had met in the Army Air Forces (Link & Coleman, 1955, pp. 929ff).

Major D. M. Green, who deployed overseas as the XXI Bombardment Group Surgeon, flew several B-29 combat missions from Saipan, including the first B-29 raid over Tokyo on 24 November 1944. No casualties occurred on his aircraft, but fliers on other B-29s attended to several lightly wounded crewmembers. Such care was a necessity on missions with flight times of 6-8 hours in each direction, so first aid supplies and training had high priority. A flight line emergency treatment facility was built for triage and stabilization of the 20 or so casualties from every mission before their transport to the main hospital 5 miles away. The Commanding General wrote of his increasing confidence in "the squadron commander-squadron surgeon team," and the increasing influence and importance of the squadron doctors due to the ever-increasing tempo of operations (Link & Coleman, 1955, pp. 950ff).

Toward the end of the war, major combat units in the Pacific Theater had a non-effectiveness rate that did not exceed 2% even during their heaviest operations. Equally important, medical administration procedures, no longer cumbersome, did not uselessly waste aircrew flying days. Line and medical commanders learned well the major lessons of aeromedical support to operational combat units by the end of the war, lessons that "were little different from those reached in World War I by General Lyster [first Chief Surgeon of the Air Service]" (Link & Coleman, 1955, p. 965).

More than fifty-five years after the war's end, Dr. Lowell L. Eddy, a former flight surgeon, recalled sitting with Lt. Gen. Jimmy Doolittle beside the runway at Kadena, Okinawa in 1945. Doolittle had arrived to establish a command post for the Eighth Air Force, which was being transferred from the European Theater after the German surrender (Link & Coleman, 1955, p. 964). Although he was now commanding heavy bomber units, Doolittle still had great affection for the B-25s flown by the squadron that Dr. Eddy supported, and so the two of them, the general and the flight surgeon, would chat while awaiting the medium bombers' return. On one occasion, Doolittle helped Eddy treat a flier's wounded hand, and rode in the ambulance to the station hospital with the doctor and the patient (Lowell L. Eddy, M.D., personal communication to DRJ, 15 October 2000).

Flight surgeon participation in developing and equipping new aircraft gives clear evidence of the value of translating combat lessons into corrective action. Flight surgeon experiences with the earlier medium and heavy bombers provided the basis for such developments, and so the B-29 squadrons did not have to learn them anew. No one can estimate the lives saved through such innovations, but the lesson does not require statistics: its justification is self-evident. Further, many of these flight surgeons later accompanied their B-29 units into the Pacific Theater and flew the combat missions themselves as medical observers.

The End of the War

In October 1945, psychiatrist-flight surgeon Maj. David G. Wright compiled a series of flight surgeon reports. The Josiah Macy, Jr. Foundation published the booklet, which the Air Surgeon of the Army Air Forces, Maj. Gen. David N.W. Grant, ordered distributed to all flight surgeons (Wright, 1945). This booklet brought together the observations of U.S. Army Air Forces flight surgeons around the world. Those from the Pacific Theater emphasized the geographic isolation and uncertain living conditions, the frequent unit moves to relatively unimproved airfields, the boredom, rain, diseases, and growing combat fatigue of their units.

A flight surgeon in New Guinea supporting P-39 and P-40 pilots provided the following list of common squadron medical problems: "dysentery, diarrhea, dengue, malaria, hookworm, fungus infections and tropical ulcer." He also mentioned humidity, tropical rainfall, highly contaminated soil, mosquitoes, insects, flies and vermin, along with poor food and generally monotonous patrol flying over jungle and ocean: in 3047 sorties flown in four months, pilots reported only five contacts with the enemy (Dougherty, 1945). Another source notes that the diseases most affecting air operations were malaria, diarrhea, dengue, scrub typhus and schistosomiasis. Mosquitoes, mites, food and water carried diseases. Venereal diseases accounted for more man-days lost than enemy action (Link & Coleman, 1955, pp. 794-5).

One flight surgeon summed up his view of his duties:

> "The management of individual pilot problems requires close association and observation of the flyer. It is believed that it would be ideal and to the best interest of the service and aviation medicine if the Flight Surgeon's duties could be restricted to the care of flyers insofar as possible. The Flight Surgeon should be able to appraise pilots, to recognize early signs of fatigue, tension and anxiety states, to distinguish the fundamentally unstable type with his peculiarities, from the sound pilot and to make wise decisions relative to resting and grounding. Further, the pilot should be made to feel that the Surgeon is with him, that he appreciates and understands his situation. Without pampering or sentimentality, a tacit sympathy between pilot and surgeon should be created" (Kaplan, 1945).

As the war ended, the Aeromedical Research Laboratory at Wright-Patterson Field instituted a survey of fliers returning from the various combat theaters concerning their opinions of the support they received from flight surgeons (1945). The question: "Of what value was your squadron flight surgeon" was asked to 2700 men of all Army Air Forces returning home. Since 3.5% failed to answer, data came from 2600 men. Some 45% answered with a word or phrase, such as "All right," "Good," "No contact," or "Not worth a damn." The others

were more articulate. Of the 2600 replies, 71.6% were favorable, 10% were non-committal, and 18.4% were unfavorable.

Leading favorable factors were general (18.9% "Always on the ball," "Did everything for us," and 14.6% were "OK" or "Satisfactory"). A small percentage offered each of many varied reasons; i.e., "Grounded fliers who needed it," "Available at all times for consultation," "Lectures and attention to physiological training and personal equipment," "Present at briefings, takeoffs and landings," "Personal interest in fliers," "Personal counseling," "Flew combat missions," "Professional skill." No pattern of unfavorable comments emerged, although a small percentage offered each of such observations as "Does not have interest of fliers at heart," "Failure to recognize fatigue or ground for ailments," "Seldom available," " Failure to fly combat missions," and "Drank too much."

The report ended with these words:

> "CONCLUSIONS: Flight surgeons have made an important contribution to the winning of the war in the air; by their preoccupation with the personal problems of the flier, they have played an essential role in maintaining the morale and efficiency of AAF combat men.
> "RECOMMENDATION: That the finding of this survey be communicated to AAF Flight Surgeons as a tribute from the personnel they have been serving" (Aero Med Lab, 1945).

Conclusions and Lessons Learned

In the introduction to this report, the authors proposed the hypothesis that the professional services provided by flight surgeons have a measurable effect upon the safety, health and effectiveness of flying units in time of war. As in World War I, the efforts of flight surgeons in World War II met these criteria. We have cited pertinent statistics throughout this section to support this hypothesis in the areas of safety, health and effectiveness. Specific examples include the estimated five thousand lives saved by Grow's attention to body armor and to rescue and recovery procedures and training, the increased effectiveness that invariably followed the institution of R&R policies and combat tours, and the progressive improvements in non-effectiveness rates as the war continued. Perhaps the best example is the end-of-war survey of the aircrew themselves. Favorable comments, the great majority, described a successful system of flight surgeon care. The unfavorable comments concerned the failings of individual flight surgeons, not the system. Contemporary accounts of line officers and medical authorities offer further confirmation of the contributions of operational flight surgeons. Specific aeromedical lessons learned or relearned were:

1. *When combat seems likely, review flight surgeon selection, training and assignment policies.*

Impending combat is a potent stimulus for change. The likelihood of U.S. entry into WW I in early 1917 and into WW II in 1940 led authorities to evaluate the concept of the flight surgeon and to develop training appropriate to the specific conditions. Such reassessment of potential flight surgeon roles should be undertaken whenever hostilities appear likely, so that flight surgeons assigned to operational units may be prepared for the specific anticipated combat situations. The School of Aerospace Medicine should upgrade its routine curriculum and provide student flight surgeons with timely training given by flight surgeons with recent

combat experience. The upgraded training material should also be distributed to flight surgeons already in the field.

2. *Provide in-theater training for assigned operational flight surgeons.*
Wilmer opened an in-theater aeromedical training facility in WW I, and Grow and Armstrong did so in WW II. As WW II went on, other senior flight surgeons established in-theater training programs and medical consultation centers, disseminated newsletters and bulletins to operational flight surgeons, and provided base-level consultation. The proven value of in-theater teaching and supervision of operational combat aerospace medicine by seasoned veteran flight surgeons may prove useful should the U.S. again undertake prolonged combat operations in one location.

3. *In-theater assignments must go to the best flight surgeons available.*
Levies upon fixed facilities must specify the assignment of the most capable, rather than the "most dispensable," flight surgeons to initial combat operations. As combat rotation policies become established, these capable and experienced flight surgeons may be identified for reassignment to more responsible positions in theater, or for teaching positions in flight surgeon training courses in the theater or in the U.S. to pass their knowledge on to their successors.

4. *Assigning authorities should give priority of assignment to senior and experienced flight surgeons in support of potential combat units, rather than assigning junior and inexperienced flight surgeons.*
When newly trained flight surgeons must be assigned to operational units, they should be supervised in the field by the most experienced and motivated senior flight surgeons then on active duty. As WW II began, senior and experienced flight surgeons assumed roles of aeromedical leadership in the combat theaters, not only in high headquarters, but also in intermediate commands. Since the squadron-level flight surgeons were generally new to the service and to aviation medicine, as well as inexperienced in combat support, close supervision helped the young flight surgeons accommodate to their new responsibilities. Such examples of senior flight surgeon leadership, and the effectiveness of these programs, should serve as a model in future conflicts.

5. *Deploying flight surgeons should plan to be medically self-sufficient for at least a week after arrival in a combat theater.*
Experience in the Mediterranean and Pacific Theaters demonstrated the value of having medical personnel prepared to provide immediate care using medical supplies and equipment carried on the same transport that brought the personnel. One should not depend on "the system" for such necessities in the confusion of war.

6. Flight surgeons *should fly with their units under local unit command supervision.*
In WW II, the highest line and aeromedical authorities established the policy of flight surgeons flying as observers with their aircrews whenever possible, including combat and combat support missions, and provided evidence of the benefits of this practice. Aeromedical authorities should endorse this policy to line commanders at all levels during

combat operations, explicitly delegating its implementation to the discretion of local flying unit commanders (as it is in peacetime), rather than imposing criteria from afar.

7. Establish specified combat tours for operational units.
Modern commanders should not forget the circumstances that led their illustrious predecessors to establish combat tour policies for aircrew as soon as possible, and modern flight surgeons should remind any commanders who neglect this matter.

8. Establish rest and recreation programs if combat tours will exceed six months.
The more intense the combat, the more combat fatigue will result. The most compelling measure of combat intensity is the loss of aircraft and aircrew, followed by the quality of enemy antiaircraft measures. Hours flown and days of unrelieved duty also contribute to fatigue. The beneficial effects of planned rest periods are clear and immediate. Although establishment of R&R programs was not the responsibility of the flight surgeons, aeromedical observations, reports and recommendations about the health and morale of fliers formed the basis upon which commanders took corrective actions.

9. Public health, sanitation and safety are basic needs. Flight surgeons, who are generally the first Air Force medical personnel assigned to a new base, must be well trained in these areas. Sports injuries and motor vehicle accidents also detract from combat readiness, and flight surgeons must monitor the safety of these areas as well.
Throughout this war, as with all wars, more man-days were lost from diseases and injuries, and from symptoms arising from matters of morale and mental health, than from enemy action. The history of air operations in the various theaters clearly demonstrates the value of well-trained flight surgeons who identified problems and recommended solutions. Flight surgeons had to establish and monitor matters of sanitation, nutrition, preventive medicine and public health far removed from topics ordinarily studied in the United States. Sports programs must be supervised for physical fitness of participants and for adherence to rules. Motor vehicle safety should also be monitored. Flight surgeons should counsel their fliers to be cautious in sports and vehicular activities (e.g., motorcycles) in the rough and ready ambience of a combat theater, since even a sprained ankle may ground an aviator for a week or more.

10. Knowledgeable flight surgeons must participate in all stages of the development and deployment of new weapons systems. Pilot-physicians are particularly useful in this role.
Senior operational flight surgeons participated at all levels of research and development of new aircraft and weapon systems, and some accompanied these aircraft into action. Lessons hard learned in combat could thus be sent to colleagues in the U.S. and translated into corrective action without having to learn them again. Such flight surgeons may also contribute to development of aircrew personal and protective equipment, and of aeromedical support equipment for aircrew and air-evacuated patients.

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CHAPTER 3

1945-1953: THE COLD WAR: BERLIN AIRLIFT AND THE KOREAN WAR

1945-1948: The Cold War Begins

The author of an encyclopedia devoted to the Cold War uses five introductory paragraphs to discuss his uncertainty about the date when that period of history ended. He considers the fall of the Berlin Wall in 1989, the signing of the Treaty on the Final Settlement with respect to Germany in September 1990, the Paris summit on Security and Cooperation in Europe and the signing of the Conventional Forces in Europe disarmament treaty in November 1990, and President Clinton's election in November 1992 (Arms, 1994, Preface, p. *x*).

As if to emphasize the nebulous nature of this period, the author does not mention any event as a possible opening date for the Cold War. Winston Churchill gave his "Iron Curtain" speech on 5 March 1946 at Fulton, Missouri (Arms, 1994, p. 127). Walter Lippmann coined the term "Cold War," and published a book by that title in 1947 (Arms, 1994, p. 361). As its earliest Cold War citation, the Readers Guide to Periodical Literature lists an article published on the last day of 1948 that opens with the words, "'Cold war,' between rounds, is a draw so far. Three years of tension finds Russia and the West about where they started." The article goes on to cite the 1945 conferences between the leaders of Russia, England, France and the U.S. at Yalta and Potsdam as opening events in this ongoing confrontation ("US News & World Report," 1948).

The years that opened the Cold War included great changes for the U.S. Armed Forces and their medical services. The end of WW II in 1945 saw a great general demobilization, with most wartime operational flight surgeons returning to their civilian careers by early 1946. General Henry H. ("Hap") Arnold retired in 1946 as Commanding General, U.S. Army Air Forces, as did Major General David N.W. Grant, the Air Surgeon throughout the war. General Carl A. ("Tooey") Spaatz assumed command of the Air Forces, and Major General Malcolm C. Grow, who had been Eighth Air Force Surgeon under Gen. Spaatz's command, became the Air Surgeon and then the first USAF Surgeon General. Grow served until 1 December 1949, when he retired and was succeeded by Maj. Gen. Harry G. Armstrong, who served as Surgeon General throughout the course of the Korean War (Wilson, 1960, p. 5). Many senior career flight surgeons whose experience in aviation medicine dated from the 1920s and 1930s retired from the service soon after WW II ended. The relatively few experienced flight surgeons who remained in the U.S. Army Air Forces after the general demobilization provided some aeromedical support for the fliers, but many served primarily as medical liaison or senior staff officers.

A new era dawned for the Air Force and its aeromedical support in 1947 when, by order of President Harry S. Truman, the USAF became a service separate from the U.S. Army. However, the Army Medical Corps continued to furnish all medical support to the USAF

until the organization of a separate USAF Medical Corps on 1 July 1949 (Armstrong, 1950; Peyton, p. 129; Link & Coleman, 1955, p. 976; Wilson, 1960). On that date, 1182 medical officers transferred from the Army to the Air Force (Wilson, 1960, p. 3), including all but one of the active duty Army flight surgeons. Maj. Gen. Benjamin R. Baker (USAF, Ret.) asserts in his oral history that the non-flight surgeon clinicians tended to stay with the Army while the flight surgeons transferred to the Air Force (Watson, USAFHRC oral history interview, 9-10 May 1990).

The one exception to the mass transfer of flight surgeons from Army to Air Force uniforms was Lieutenant Colonel Rollie M. Harrison. The reason for his decision is unknown, but he remained at Fort Sill, Oklahoma where the new core of Army Aviation formed around the flight training center there. Harrison served as the only flight surgeon at Fort Sill and came to be known as the "Father of Army Aviation Medicine." The dispensary at Fort Sill was renamed the "Harrison Aviation Medicine/Family Practice Clinic" in 1985 (Williams, 1999; information also from an undated, unpublished biography of Dr. Harrison by Kevin T. Mason, Major USA MC FS in the possession of DRJ).

Another Army physician soon joined Harrison in the flight surgeon ranks. Spurgeon H. Neel, Jr., MD, a medical officer who had left the Army five months previously for a civilian practice, returned to the Army just before the 1949 medical service transfer. Although he wished to become flight surgeon, he felt it would have been ungrateful to accept his Army commission and then transfer to the Air Force within the same week. Instead, he remained at his post and later took USAF flight surgeon training as an Army officer. Neel went on to become a prime developer of tactical helicopter air evacuation in Korea and Vietnam, and a widely recognized expert in aviation medicine who trained many Army and Air Force flight surgeons. He retired in the rank of Major General (Spurgeon G. Neel, Jr., MD, Maj Gen MC USA [Ret.], USAFHRC oral history interview 7 Mar 1977 and personal communication to DRJ, 2001).

The history of the separation of the two Medical Corps far exceeds the scope of this report, but one observation is pertinent. A recurrent theme since WWI had been the matter of whether aircrew should have specific physicians and medical facilities dedicated to their care. Only three months after Col. William H. Wilmer and his Medical Research Laboratory arrived in France in 1918, Col Thomas R. Boggs, Medical Consultant to the American Expeditionary Force Air Service, wrote a memorandum to the Chief of Air Service suggesting that a special Medical Service for the Air Service be established, separate from the Army Surgeon General's Office (Wilmer, 1920, p. 32). A detailed 1925 report on the Army Medical Department organization notes that the Medical Section of the Air Service (then comprised of 50 flight surgeons and 218 enlisted medical technicians) was assigned to the Chief of the Air Service rather than to the Army Medical Corps in general. The Medical Section also supervised the School of Aviation Medicine at Randolph Field in San Antonio, and this school was not listed among the other Medical Corps institutions (Tobey, 1927, pp. 84, 95ff). The theme of functional separation of aviation medicine from general Army medicine recurs in the historical studies of Link & Coleman (1955) and Meiling (1984). Such an arrangement "for all practical purposes, had been in effect for over a third of a century" before the separation of the Air Force from the Army (Armstrong, 1950). The

preponderance of historical data during WW I and thereafter had clearly indicated that fliers returned to duty faster when flight surgeons provided their care or, when specialty care was necessary, monitored that care and made the final aeromedical dispositions. From that day to this, flight surgeons and their enlisted staffs have tended to give this administrative action a higher priority than do medical personnel whose primary duty is the care of all ill patients. The validity of this finding did not cease when the Air Force left the Army. Drawing on Air Force experience, the U.S. Army went on to organize its own School of Aviation Medicine at Fort Rucker, Alabama in 1954 after the helicopter training school moved there from Fort Sill. The Army has had a separate flight surgeon service ever since.

The Air Force careers of the authors of the present report (1956 to the present) extend over most of the period since the establishment of a separate U.S. Air Force. Our experience has confirmed this lesson: *sick or well, fliers need aeromedical management in order to provide for safe and effective flying, and flying effectiveness begins with healthy fliers being present for duty and fit to fly.* Efficient management of the paperwork required to return grounded fliers to the cockpit has little glamour, but is an essential part of reducing the flying time that fliers lose from illness.

Flight Surgeon Training and Roles After World War II

We have seen how William Wilmer and Isaac Jones, under Theodore Lyster's supervision, helped to define and develop the roles of the first flight surgeons during 1917-18. Wilmer and Jones were trained medical reservists brought onto active duty by the wartime buildup, and they returned to civilian life immediately after the Armistice. A handful of flight surgeons remained active in aviation medicine after WW I, and aviation medicine developed in both the civilian and the military arenas through their efforts. The military role in this new medical field diminished as the force shrank between the wars, and only a few men kept aeromedical research and its clinical applications active during the 1920s and '30s. Such leaders as Armstrong, Benson, Grant and Grow were supported through these lean times by their civilian colleagues: Bauer, Greene, Jones and others in the small Aero Medical Association. Preparations for World War II included mobilization of medical reserve units, introduction of Selective Service ("the draft") for physicians, and a greatly increased training program for flight surgeons. Aeromedical research, operational experience, in-theater training programs and hard-learned lessons about aeromedical support for military fliers, all thoroughly documented through scholarly reports, contributed to the accumulated knowledge of ways in which flight surgeons might contribute to the safety and effectiveness of military aviation, as we have already seen.

As the Cold War became a fact of American life, Universal Military Training for all physically fit young men continued under the draft policies instituted by the Selective Service Act of 1940. Considerable efforts to retain physicians in the military, or to attract back those who had served in WW II, were fruitless. The Army Surgeon General, Maj. Gen. Norman T. Kirk, wrote in 1946, "Much of the unwillingness of the young physician to enter the military service is due to his belief that the Army denies to him...opportunities for professional advancement, for postgraduate education, for certification by professional specialty boards and for clinical research and self expression (cited in Apel & Apel, 1998, p.

9). A plaintive essay by the Navy Surgeon General discusses this period, pointing out that several thousand blank application forms sent to members of the American Medical Association generated only 33 replies (Pugh, 1954). Medical Education for National Defense (MEND), a program instituted in many medical schools, was equally non-productive.

The critical shortage of military physicians early in the Korean War led to a series of legislative efforts to ease the situation, ending with the 81st Congress passing the Doctor Draft Bill, Public Law 779. This law obligated all eligible physicians to serve two years in the armed forces after September 9, 1950 (Apel & Apel, 1998, p. 14; Pugh, 1954, Wilson 1960, p. 8).[36] All American men registered for the draft at age 18, and those in pre-medical training were offered a choice: either apply for a deferment until the end of medical school and internship or face possible immediate drafting on the same basis as all other men. Every physician under age 50 had to register for the draft, and induction eligibility extended to age 51. Priority of induction was: 1) doctors with service-sponsored training who had served less than 90 days, 2) those with this training who had served more than 90 days but less than two years, 3) doctors with no military service, and 4) those doctors who had served since 15 September 1940, called in inverse ratio to their length of service (Apel & Apel, p. 14). This system drafted interns and residents first, and so it did not provide a cadre of experienced physicians to replace those who had retired after WW II.

Forced to choose between deferments through medical school in order to serve as military physicians or immediately induction as Army privates, most medical students picked the former alternative. Another choice was available after internship: a young doctor could continue into residency training if the specialty was one of possible use to the armed services, or accept military service at that point and take the residency at the end of the two-year service. Some chose the first path, some the second. (The reader must keep in mind that in 1950 only about 22% of U.S. physicians were specialists; the remainder were general practitioners [Bowers, 1950].) The new Doctors' Draft elicited 3958 applications from physicians for Reserve commissions and 259 for Regular commissions between 1 July and 31 December 1950 (Wilson, 1960, p. 8), and the new acquisitions almost tripled the number of USAF physicians to 2800.

WW II flight surgeons had served tours of three years or longer, frequently with the same unit. They entered the service knowing that they would likely serve until the war ended, and up to six months longer: "...an appointment in force at the outbreak of the war or made in time of war, will continue in force until six months after the termination of the war..." (Tobey, 1927, p. 93). In the jargon of the day, this policy was referred to as "the duration plus six." Now each flying unit received aeromedical services from a succession of new flight surgeons who were really Aviation Medical Officers or Flight Medical Officers

[36] Some of these legislative efforts and their military corollaries may be traced through essays in issues of the "U.S. Armed Forces Medical Journal" (Casberg, 1950; Editorial, 1954;Fielding, 1951; Robinson 1950 a, b, c, 1951; Strickland & Nuernberger, 1953). The history of the involuntary drafting of physicians into U.S. military service, or the use of the threat of the draft to induce semi-voluntary service, exceeds the scope of this paper. The interested reader may wish to consult Anderson's comprehensive annotated bibliography on involuntary military service in the U.S. (Anderson, 1976).

(AMOs or FMOs),[37] although no one called them that and so the terms will not be mentioned further. Each of these young doctors served in a unit for less than two years. These flight surgeons finished their internships on 30 June of a given year, entered the Air Force in July, attended military orientation (Strickland & Nuerenburger, 1953) and flight surgeon training, and reported for duty in September. They knew that after they graduated from U.S. Air Force School of Aviation Medicine (USAFSAM or "SAM"), they would perform operational duty for 20 months, take terminal leave, and depart for their civilian residencies or new practices in late June. As a result of this cycle, each year flight surgeons became a scarce commodity from June through August. Rare indeed was the unit flight surgeon who had experience at more than one location and in more than one aircraft type.

Exact numbers are not easily available, but the ratio of older to younger flight surgeon was probably about 1:10.[38] Many small medical facilities had an experienced medical commander and a professional staff that included up to 20 drafted physicians. These doctors were familiarly known as "Berry Planners," a name derived from that of Frank B. Berry, M.D., the Assistant Secretary of Defense for Health Affairs during this era, who had developed the plan for deferring draft-eligible physicians until they completed their residencies. Inevitably, some drafted doctors were disgruntled at being in the service. In a study of Air Force medicine during the Cold War, one must remember that these physicians are *probably the only group ever drafted directly into the USAF,* and were also the only persons to serve two-year active duty AF tours rather than the four years required of the all-volunteer force.

The Berry Plan physicians' attitudes toward military service greatly affected the line-medical relationship of that time. Soon after the Air Force became a separate service, flying unit commanders could no longer assume that their flight surgeon knew much about the Air Force beyond superficial impressions. Neither could commanders assume that these flight

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[37] For reasons too complex to discuss here, such physicians in that era received designations as AMOs, and later as FMOs, rather than receiving their flight surgeon rating upon graduation from USAFSAM. AMOs, designated from 1947-1961, had to qualify for their flight surgeon wings by serving two years on flying status and logging 200 flying hours. The later FMOs, designated after 1962, had to serve for one year and log 100 hours to qualify. *Designated* flying officers wore the same wings as enlisted aircrew such as loadmasters, and then only when they were on active flying orders. This set AMOs and FMOs apart from the flight surgeons who, as *rated* flying officers—pilots, navigators, bombardiers, flight surgeons— received distinctive wings that signified their professional duties. The non-rated AMOs and FMOs, alone among rated and designated fliers, could not wear wings after graduation from training unless they were on flying status. AMOs and FMOs received non-rated, non-flight crew hazardous duty pay ($100 per month) rather than drawing rated flight surgeon flight pay of $130 per month. Since most of the AMOs and FMOs served only 22 months on flying status, few AMOs qualified for their wings or for full rated flight pay, although FMOs did so after their first year. The universal practice at operational bases was for these young doctors to be called "FSs" and to wear flight surgeon wings without authorization and without drawing the rated pay. The terms "AMO" or "FMO" were used only on official documents. No official objection to this informal practice was ever recorded by medical headquarters or inspectors (information from the experience of DRJ).

[38] No data are available for the period of the Korean War (1950-53). One of the authors (DRJ) served as a cadre flight surgeon from 1960-75. About 76 flight surgeons, mostly Berry planners, worked directly for him during that time; all but seven were on their first assignment. All the 2-yr flight surgeons had volunteered to become flight surgeons, and all but three served honorably and well. However, all began as absolute neophytes and, by the time they were experienced, most chose to leave the service. Only six extended their active duty beyond their draft obligation to take military residency training, two in aerospace medicine.

surgeons had any particular interest in the service, its traditions or its mission. To their credit, most of these young doctors did have some interest in aviation, or developed it, and bonded well with the squadrons they served. The fact that they were about the same age and of the same demographic background as the aviators for whom they cared helped with this bonding, as did the fact that the flight surgeon was usually the person with the most formal education in the squadron environment. However, the era in which the fliers could assume that their flight surgeon was a mature and experienced physician had ended. With their customary straightforward appraisal of reality, the fliers developed an ironic greeting to fit the situation: "Are you a flight surgeon or a real doctor?"

The fact that flight surgeons at overseas bases after WWII furnished general medical care to families of fliers on a "space available" basis contributed to fliers' acceptance of their young doctors (Personal communications from Burt A. Rowen, Col USAF MC (Ret.) and Geoffrey P. Wiedeman, Jr. Brig Gen USAF MC (Ret.) to DRJ, 2001). Flight surgeons later began to provide such care at all USAF bases where families accompanied the fliers.[39] This practice had several advantages that led to its official approval and encouragement. First, and most importantly, when the fliers in a squadron considered the flight surgeon to be their family doctor, the professional bond between the flight surgeon and the unit became stronger. Knowing the families gave the flight surgeon a perspective about the fliers different from that of the office or the flight line. Since the fliers were a generally healthy group, treating the illnesses of family members kept the flight surgeons professionally sharp and up to date. Finally, shifting basic care of fliers' wives and children from other clinics to the flight surgeons diminished some effects of the general shortage of medical personnel. This family practice was especially important where options for off-base medical care from civilian sources were limited or absent, as was frequently the case overseas. Thus, wives accompanying their pilot husbands to bases in Japan as a part of the occupying forces in 1945-1950 routinely received outpatient medical care from flight surgeons, and the flight surgeons came to regard this as an integral part of their duties.

The Air Force assigned its new Berry Plan medical specialists—those who had completed residencies—as orthopedists, surgeons, ophthalmologists, or whatever their just-completed training dictated, rather than training them as flight surgeons. Thus, a young doctor just out of internship with essentially no experience as an independent, unsupervised physician became the "average" squadron flight surgeon during the period just before the Korean War. He (no women served as military physicians until 1954 [Editorial, 1954]) would receive two weeks of military indoctrination and about seven weeks of aeromedical training and then go to his first military assignment. Until the Army established its School of Aviation Medicine at Fort Rucker in 1954, all Army and Air Force flight surgeons trained at USAFSAM. The Navy trained its flight surgeons at the Naval Aviation Medicine Institute at Pensacola Naval Air Station, Florida. USAFSAM had relocated from Mineola, Long Island, to Randolph Air Force Base (AFB) ten miles east of San Antonio, Texas in 1931, where it remained until 1960, when the Air Force opened a larger facility southeast of San Antonio at Brooks Air

[39] The Dependent Medical Care Act, Chap 55, Title 10 US Code, authorized medical care for family members and retirees at all military installations on 7 Jun 1956. (Cited in "Questions for the 50th Anniversary of the Air Force Medical Corps, www.afms.mil/history/questions.htm.)

Force Base (Peyton, 1968, p. 76). Now designated the School of Aerospace Medicine, SAM remains at this location. (Brooks Air Force base was recently renamed Brooks City-Base.)

Some older WWII flight surgeons who stayed in the service had taken subsequent medical specialty training in non-aeromedical fields, serving as specialists in those fields. Some of these had moved on to command, staff and educational positions. A few experienced flight surgeons wished to continue their USAF careers in clinical aviation medicine. In 1948, the USAFSAM offered an Advanced Course in Aviation Medicine ("ACAM" or "the Long Course") that extended over a normal nine-month academic period. The ACAM lapsed after two years, mainly because of the pressing need for flight surgeons in Korea after the summer of 1950. The USAF replaced the Long Course with a three-year Residency in Aviation Medicine ("RAM") when Aerospace Medicine became a medical specialty under the American Board of Preventive Medicine in 1953 (Peyton, 1968, p. 167). [40] The ACAM and the RAM graduated about 15 men each year, mostly senior captains and majors. They formed a nucleus of career flight surgeons capable of commanding or supervising the 2-year flight surgeons at base level. Some senior flight surgeons took neither of these courses, but were "grandfathered" into certification based on their training and experience upon the establishment of the specialty board.[41]

1948: The Berlin Airlift

Four victorious allies (US, UK, France, USSR) occupied Germany at the end of WW II. The Soviet Union maintained military control over East Germany but not over Berlin, which, though deep in Soviet-controlled territory, comprised four sectors, each controlled by one of the occupying powers. Increased tensions between the occupying powers in April 1948 led the USSR to announce a series of limitations on travel into Berlin from the west. These actions effectively cut the city off from highway, rail and river barge supply lines, leaving the three air corridors into Tempelhof Airport as the only way in or out of the city. The newly formed USAF, along with U.S. Navy aircraft, undertook the relief of the city by airlift until the Russians lifted their blockade 11 days later. The Soviet forces resumed their blockade on 25 June 1948 and the airlift began again with no idea how long the standoff would last. Those who flew and supported this humanitarian aerial resupply operation knew it as Operation Vittles, and history records it as the Berlin Airlift. The effort was, and remains, an unparalleled achievement of the USAF, U.S. Naval aviation, the British Royal

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[40] Dr. Louis H. Bauer, former commander of the School of Aviation Medicine, well-known aeromedical expert and long-time editor of the "Journal of Aviation Medicine," first proposed in 1941 that Aviation Medicine become a fully accredited medical specialty. The project languished during WW II. Maj. Gen. Malcolm C. Grow reopened the issue in 1947, and the combined efforts of the Aviation Medicine Association and the USAF brought the undertaking to fruition. The American Medical Association accepted Aviation Medicine as a specialty in 1953. USAFSAM expanded its former ACAM into the core of the newly accredited three-year residency. Peyton fully documents the history of the acceptance of Aviation Medicine (now Aerospace Medicine) as a specialty under the American Board of Preventive Medicine (Peyton, 1968, pp. 163ff). The U.S. now has four such residencies located at the USAF School of Aerospace Medicine at Brooks City-Base, Texas; the U.S. Naval Aviation Medicine Institute at Pensacola Naval Air Station, Florida; Wright State University in Dayton, Ohio; and the University of Texas Medical Branch in Galveston, Texas.

[41] The "U.S. Armed Forces Medical Journal" of December 1954 lists 42 military physicians as newly certified specialists in aviation medicine when the Board was established. Four were lieutenant colonels and the rest were colonels or flag rank officers (News article, 5:1833-4).

Air Force and the French Air Force. All elements of aerial support, including the aeromedical portion, were cobbled together on the spot as the situation developed. Some 3000 fliers and support personnel from many squadrons and units began a continuous 24-hour flow of transport aircraft.[42]

When the Berlin Airlift began, the U.S. Air Force in Europe (USAFE) had only about 15,000 troops; the number soon swelled to 28,000. Some 30 physicians provided their care, so the ratio of physicians to troops fell from about 1:500 to 1:1000. The number of USAF aircrew increased from about 2000 to about 3000 during the airlift; no record of the number of flight surgeons providing their care is available. Many of the augmentee fliers came in on temporary orders, expecting to go home in a few weeks. As their tours grew progressively longer, morale declined. An inspecting flight surgeon reported some of the problems faced by aircrew and their flight surgeons. He noted "sudden dislocation, uncertainty about the length of the operation, inadequate messing facilities [though only one food poisoning epidemic occurred], lack of laundries, scarce and crowded housing sometimes located miles from the air bases and with inadequate transportation, and lack of such amenities as adequate lighting, hot water and toilets." Further, as the airlift continued, the status of some troops changed from temporary to permanent, and so their families began to join them. Some resort hotels were renovated as family quarters, but many were located over 100 miles from the bases, and so fliers could only see their families once or twice a month, and then only by sacrificing their own aircrew rest periods (Moseley, 1950).

This operation represented the first major deployment of the new Air Force. The deployment stressors these troops encountered have occurred in every such deployment since then, and flight surgeons may expect and must plan for the same stressors in every future deployment. *Note especially that whenever families can possibly join the fliers some will do so, no matter how stringent the conditions.*

The crews worked without respite at first, and operational fatigue became a major concern. The USAF established a schedule of three days on and two off, alternating day and night flying, which led to progressive fatigue. The U.S. Navy set up a schedule of 15-day stints of 15 hours on and 12 to 15 hours off, followed by a rest period of 5 days; the five-day rest periods alleviated the progressive circadian dysrhythmia and fatigue. Finally, USAF authorities switched their fliers to the Navy schedule (Nauman, 1951).

Flight surgeons found that "cases of removal from flying because of operational fatigue were usually the result of environmental and adjustment factors rather than concern over flying" (Nauman, 1951). Fear of survival was not a factor, since no actual combat was involved and the accident rate was continuously less than that of flying activities in the continental U.S. Many crewmembers complained of tiredness, indigestion and similar manifestations of fatigue and maladjustment that arose not from flying, but rather from the vicissitudes of living.

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[42] Data from http://www.wpafb.af.mil/museum/history/postwwii/ba.htm and http://www.thehistorynet.com/AviationHistory/articles/1998/0598_text.htm.

Scheduling of aircrew (as opposed to aircraft) was delegated to squadron and group commanders as dictated by mission demands. Two general types of duty schedules during the 15-day stints developed: 8 hours on followed by 16 hours off, and 12 on followed by 24 off. Aircrew meals were available 24 hours a day. One side effect of the rest periods was that the greatest source of lost time for fliers (greater than all other causes combined!) became the skiing fractures incurred at the Garmisch rest area (Nauman, 1951). Whatever the official schedule, the fact was that, considering non-flying duties and transportation times, the actual schedules of individual fliers were approximately half time on and half time off. Further, day sleepers found that many post or base facilities were closed when they were awake at night: exchanges, laundry, and recreational outlets. "The combination of long duty hours, interrupted sleep, and inadequate recreation detracted from human efficiency and from the performance of the mission" (Moseley, 1950, p. 1257).

Working without relief is common during the first few days of any operational military deployment, and flight surgeons should be especially alert for signs of fatigue. *The lesson to be learned is that a schedule of flying days and days off should be established as soon as possible.* Aeromedical and command attention to the off-duty recreational activities of fliers may contribute to maintaining their availability to fly when on duty.

A corollary complication was that medical under-manning allowed for only one full work shift per day, always allocated to daylight hours. "Aircrew personnel frequently could not meet normal sick call hours because of their schedules, and were reluctant to ask for special consideration. Early symptoms were often neglected and many prophylactic measures not effected. Thus, the forced conservation of medical personnel had the net result of intensifying the need for medical attention" (Moseley, 1950, p. 1257). The lesson learned by this experience was that *lack of sufficient medical personnel would result in direct and inescapable consequences*, objectively measured by crew ineffectiveness and lost duty days.

Because the medical facilities supporting the aircrew were dispensaries (small local clinics with no inpatient beds), many of the data usually used to study aircrew medical effectiveness are not available and may never have been recorded. Flight surgeons transferred aircrew with significant illnesses to larger Army facilities. These hospitals found it impractical to break down the numbers of hospitalized fliers by the referring bases, and therefore did not calculate non-effectiveness rates by location. Not all ill aircrew had local hospital beds available; flight surgeons had to put them to bed, unsupervised, in their local quarters (hence the term for their status, "on quarters"). Such patients had to return to flight surgeon clinics for follow-up care, and their records were kept in outpatient charts. "The majority of physicians assigned to Airlift bases were recent graduates who had little administrative experience and even less administrative interest. Inasmuch as their time was almost completely absorbed in giving professional attention to the extraordinary demands of the Airlift, there was little incentive to maintain any but the most sketchy medical records" (Moseley, 1950, p. 1257). Col. Alonzo A. Towner, assigned to the Care of the Flyer Branch of the Air Surgeon's Office in Washington, DC, spent about six weeks flying both day and night missions with the Airlift in November and December 1950. He made a comprehensive survey of fatigue and motivational factors involved in the operation (News of members, 1970). The "Care of the Flier Report," a bimonthly report sent by squadron flight surgeons

to the USAFE Surgeon and on to the Surgeon General, was maintained carefully and accurately throughout the entire operation and formed the basis for later statistical evaluations of reasons for groundings.

Official records do not record time lost from off-duty injuries, in contrast to Nauman's unofficial comments about the Garmisch ski injuries (1951). Moseley's review of official statistics shows that by far the greatest cause of lost flying time was upper respiratory infections and their complications. Unofficial reports from local flight surgeons indicated that many groundings for fatigue were concealed under this category, which may account for the days lost by Airlift fliers from upper respiratory infections being many times greater than at non-Airlift bases. Moseley states that the incidence of venereal disease among the Airlift aircrew was excessive. This rate rose as new troops arrived and then declined as better control measures were instituted, as the fliers adjusted to their new locations, and as their families arrived. "The incidence of venereal diseases in the Airlift appeared to be inversely proportional to morale and stability" (Moseley, 1950). In addition to Col. Towner's survey flights, operational airlift squadron flight surgeons made some 25 round-trips between Rhein Main Air Base and Berlin to observe crew duties and effectiveness, and reported that the greatest source of stress appeared to come from family separation factors in this new kind of Cold War (Nauman, 1951).

The Soviets, aware that the successful Berlin Airlift had become a propaganda victory for the Allies, re-opened normal road, rail and river traffic into Berlin on 12 May 1949. However, the Airlift continued until 30 September in order to rebuild a backlog of supplies. In 321 days of operations, 276,926 flights carried 227,655 passengers in or out of Berlin and delivered 2,323,067 tons of cargo, mostly food and coal. Some 80 aircrew and passengers lost their lives in accidents, including 31 Americans and 39 British.[43] The new Air Force had deployed for the first time. Flight surgeons had learned some valuable lessons, but these were not put into practice when the Korean War began less than a year later.

1950-1953: The Korean War

When the North Koreans unexpectedly invaded South Korea in June 1950, the USAF presence in that part of the world consisted of the Far Eastern Air Forces (FEAF), based in Japan and dedicated to the defense of Japan, Okinawa and the Philippines against possible Russian or Chinese Communist aggression. American involvement in the Korean conflict began with a few military advisors in Korea and some emergency tactical air support to the evacuation of Americans from the Seoul area. The U.S. effort grew to involve 5.7 million U.S. combatants (Editorial, "Air & Space Magazine Smithsonian," 2000). FEAF's Fifth Air Force, located at six bases in Japan and a few satellite fields in Korea, consisted of 33,625 officers and airmen manning some 13 fighter or fighter-bomber squadrons (F-51, F-80, F-82 [Twin Mustang], F-84, B-26), two bomber squadrons (B-29), two tactical reconnaissance squadrons (RF-80) and three transport squadrons (C-46, C-47, C-54). A few airfields in Korea were minimally jet-capable, but the USAF had no warplanes stationed there (Futrell, 1961, pp. 33, 644).

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[43] Data from http://thehistorynet.com/AviationHistory/articles/1998/0598_text.htm and http://www.wpafb.af.mil/museum/history/postwwii/ba.htm.

A brief review of the rapidly changing tactical situations of the Korean War may illustrate the aeromedical challenges placed upon the new and understaffed USAF Medical Corps. The first year of combat was chaotic and confusing, even by the standards of warfare's expected fogs and frictions. Attacking on Sunday, 25 June 1950, the North Korean army quickly took Seoul, the South Korean capital, and drove far down the peninsula in the next few weeks. Allied ground troops fought valiantly, aided by the losses inflicted upon the North Korean Army's extended supply lines through attacks by tactical and strategic USAF aircraft flying from bases in Japan. A combination of extraordinary ground and air efforts finally stopped their momentum deep in southeastern South Korea on 12 September 1950. Surprised by Gen. Douglas MacArthur's 15 September landing of UN forces at Inchon north of the battle line, and thrown back by the subsequent breakout of Allied troops from their southeastern defensive perimeter around Pusan, the North Koreans retreated behind their original border by late September. Within two months, the United Nations (UN) forces had advanced almost to the Yalu River, the northern border separating Korea from China. A few operational USAF fighter squadrons deployed from Japan to South Korea during this period. As the UN forces moved through North Korea in October and November 1950, Chinese Army forces began to cross the Yalu River in force. The shortened North Korean supply lines between the sanctuary of China and the front lines just south of the Yalu offered little space for aerial interdiction, and the combined North Korean and Chinese Armies forced the UN forces back south of Seoul by January 1951. Futrell remarks that troop morale in the Fifth Air Force in Japan and Korea had sagged so appreciably after the Chinese Communist offensive in the winter of 1950-51 that "the Air Surgeon undertook to secure psychiatric assistance, which would enable him to identify and treat morale cases before they became acute" (Futrell, 1961, p. 251). All USAF aircraft re-deployed from Korean bases back to Japan as the Communist forces moved further south. The North Korean and Chinese advance, however, lengthened their supply lines, and once more the attrition of Allied aerial attacks on tactical and logistic targets, along with the valiant efforts of the UN and South Korean ground units, halted the Communist momentum.

A stalemate developed by May 1951. Allied forces began to force the Communists back north and USAF aircraft returned to Korean bases. As the military situation improved, peace talks began. These talks went on for two years, during which time UN aerial assaults prevented the enemy from accumulating enough supplies to support any major offensive. The Chinese built a series of jet fighter bases just north of the Yalu from which MiG-15 fighters could attack at will with a safe sanctuary just minutes away. Even so, the efforts of USAF fighter squadrons (mainly F-86s) resulted in a kill ratio in favor of the Allies that varied between 6:1 and 15:1 or higher. The continued attrition and expense caused by the air war was a major factor in bringing about the final armistice agreement, signed 27 July 1953. Allied tactical airpower had dominated in its three objectives: air superiority, logistic interdiction and close air support of ground forces (Futrell, 1961).

During the war, the FEAF lost 1466 aircraft, the Marines 368, and friendly foreign units lost 152. Of the total of 1986 aircraft lost, 945 (47%) were lost to non-enemy action. Of the 1041 lost to the enemy, 147 were lost to air-to-air combat, 816 to ground fire, and 78 to unknown causes. Allied aircrew maintained almost total air superiority throughout the war,

claiming 976 enemy aircraft destroyed in air-to-air combat (Futrell, 1961).[44] Strategic air power was less dominant than in WW II; MiG-15 fighters posed a major threat to the old propeller-driven B-29 and B-26 bombers operating near the Yalu, limiting the usefulness of these aircraft in strategic and interdiction operations.[45] The USAF used no jet bombers in this war except for a few new and relatively ineffective B-45s.

As the authors of this report began their inquiry into the experiences of flight surgeons during the Korean conflict, they found a paucity of aeromedical data in the open literature that stood in marked contrast to the many sources describing flight surgeon efforts in WWI, WWII and even the Berlin Airlift. Many factors appear to have led to this situation. The USAF Medical Corps numbered 891 officers on 1 July 1950, well below its required strength of 1268 (Wilson, pp. 3-4). This reflected the services-wide medical personnel shortage, aggravated by the annual summer medical manning slump (Robinson 1950a). Recapitulating its actions at the beginning of WW II, the Air Force trained junior flight surgeons, many in the rank of first lieutenant, and rushed them into the combat theater. "These shortages were only partially alleviated by the prompt fulfillment of emergency requisitions and by the reacquisition of USAF officers on duty with the Army.

The most serious deficiencies were in the categories of flight surgeons, aviation medical examiners, and "aircraft observers, medical" (Wilson, 1960, p. 7).[46] FEAF had only 37 medical officers at the outbreak of hostilities (a ratio of physicians to troops of about 1:1000); perhaps half were flight surgeons. The command requisitioned 73 more medical officers (including 15 flight surgeons) during the first three months of the fighting (Wilson, 1960, pp. 7-9), and volunteers filled the USAF medical gap by September 1950. They may have been motivated to join the Air Force to avoid being drafted into the Army Medical Corps, which was so far under its desired strength that it had to acquire 570 medical officers from the U.S. Navy Reserves (Fielding, 1951). Some reports describe the manpower situation in the U.S. Army, and the Air Force, drawing on the same pool of physicians, must have been in similar straits.[47] Most USAF flight surgeons who served at squadron level were new to the service; many were first lieutenants on their first assignments. Their roles appear to have been about the same as in WW II, but without the support of the powerful and knowledgeable senior medical staff of that era. The young doctors were certainly as indifferent to military medicine as the flight surgeons in the Berlin Airlift already described

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[44] Several web sources attribute to the Russian "Command" magazine, Sept-Oct 1994 issue, the claim of 1300 United Nations aircraft shot down in Korea, compared to 345 Communist aircraft lost.

[45] The "U.S. Armed Forces Medical Journal" reported that Capt. Joseph James Engelbreit, a 25-year-old flight surgeon, died in an aircraft accident while flying as an observer on a bombing mission over Korea on 21 May 1953 (Deaths, 1954).

[46] The cited reference was written by Howard H. Wilson, PhD, the historian to the USAF Surgeon General in 1960. This report was never published, for reasons unknown. The current USAF/SG historian, James S. Nanney, PhD, made it available at www.afsm.mil/history/Kfront.html in 2001, and the authors acknowledge and thank him for his help and guidance in locating this and other information.

[47] The authors contacted a number of distinguished aeromedical physicians who served in the USAF during and immediately after this period. These included Lt. Gen. George E. Shafer USAF MC (Ret.), Brig. Gen. Geoffrey Wiedeman USAF MC (Ret.), Brig. Gen. Richard D. Hansen USAF MC (Ret.), Col. George R. Anderson USAF MC (Ret.), Col. Burt A. Rowen USAF MC (Ret.), Charles A. Berry, MD, and others. Several had volunteered to serve in Korea but were not assigned there because their relative seniority made their presence necessary elsewhere. These physicians could name few peers who served in Korea.

by Moseley (1950). A memoir by an Army surgeon assigned to a Mobile Army Surgical Hospital (MASH) describes the situation in that service:

> The army made little effort to acculturate its drafted doctors and nurses into the ways of the military medical community. [The usual three ways to do this are by having] a pool of experienced soldiers to share accumulated knowledge..., second, training programs..., and third, the mutual support of the present community..., often manifested as unit cohesion or esprit de corps. None of these methods of acculturation were available to the doctors...in the first half of the Korean War (Apel & Apel, 1998, p. xi).

A retired pilot who flew in Korea wrote:

> ..."about 44 of us assembled at Travis AFB, on 01 Jul 1950 to depart on a Pan Am Contract DC-4. [Although] we were in the USAF, we were still wearing out our Army Uniforms. We were all dressed alike and upon closer inspection, one would note that we were either Pilots or Doctors. There appeared to be a desperate shortage of each at this time in that part of the world. I would estimate that there were about 20 plus Doctors on this first of flights into that area. The need was desperate for their services that they were all met at the point of arrival, Haneda AB, Tokyo, by their escorts who already had their field equipment on board a waiting C-54 to take them onward to Korea" (Charles E. Bartels, Col USAF [Ret.], personal communication to DRJ, 15 Jan 2001).

Despite the USAF flight surgeons' youth and inexperience, bonding between them and their fliers in Korea took place on the same basis as in previous wars. Col. F.C. Kelly, Fifth Air Force Surgeon from 1950-52, wrote that the new flight surgeons rapidly developed their skills in aviation medicine and quickly learned to take good care of their aviators (Wilson, 1960, p. 8).

By the end of 1951, the FEAF had 236 medical officers in Japan and Korea. As the axis of tactical aviation shifted to Korea from the bases in Japan, the Fifth Air Force assumed primary control for the new bases. By June 1952, these Korean bases had full medical staffing: 155 medical officers assigned against 157 authorized positions. What experience the assigned flight surgeons gained, however, the USAF lost as the young doctors left Korea after completing their one-year combat tours. Senior medical officers remained scarce. In June 1953, two of the nine Medical Groups in Korea were commanded by lieutenant colonels, two by majors, and five by captains. Most wing commanders wished to have field grade medical officers serving as their wing surgeons, not so much for their medical expertise as for their experience and judgment concerning general base medical services and support, qualities not found in a younger officer with less than two years of military service (Wilson, 1960, p. 10). Thus, although the ratio of medical officers to assigned strength in the Fifth Air Force improved to 1: 596 (Wilson, 1960, p. 11) from its 1:1000 ratio at the beginning of the war, the experience level remained suboptimal.

Military medical experience was especially necessary at the newly built Korean bases. In contrast to the great armies of World War II, all U.S. military forces were now undermanned, and the newly organized USAF lacked the logistical support and field experience that the U.S. Army had previously supplied. An official report of USAF status in 1951 noted, "The Air Force has played a major if not decisive role in the [Korean] war...but there are numerous Air Force deficiencies many of which stemmed from failure to apply lessons learned in World War II that are in need of examination and correction." The report

mentions "inter-service differences that have been accentuated by the war...that have hindered the effectiveness of the USAF in Korea." Along with criticisms of air operational factors, the writer comments, "Air Force personnel did not easily adapt themselves to living and operating under field conditions [in Korea]. There is need for more realistic field training." The report also contained the laconic comment, "The Korean war points up a need for a modification of our adherence to the Geneva treaty to the extent of allowing us to arm all medical personnel" (Air University, 1951).

One Air Force medical officer, an Army physician during the Korean War, told of being summarily relieved from duty as a fellow in pulmonary medicine at Fitzsimmons Army Hospital and rushed to Korea within a week. As he deplaned at his destination post, the physician whom he was replacing saluted him on the flight line and boarded the same plane to depart for Japan. Communist forces overran the installation the next day. The newly arrived physician found himself the senior officer in a group of a dozen or so assorted troops behind enemy lines for ten days before they finally returned to safety. (Robert Stonehill, Lt Col USAF MC, personal communication to DRJ, 1959). Stonehill used this personal experience to convince skeptical young Air Force medical officers of the need for them to acquire some military skills.

The 1951 Air Force report did not expand on the medical situation at the air bases, nor did it offer the sources of data from which it drew its conclusions, but these comments speak for themselves about a newly constituted combat Air Force finding itself in the field for the first time without the organic support of the U.S. Army. Futrell's definitive history of USAF operations in Korea repeatedly emphasizes the deficiencies of aviation engineering services, specifically the inability to construct its own air bases (1961). If one adds to this situation the USAF command emphasis on training its officers in flying skills more than in general military skills (viz., Sherwood, 1996), and the inexperience, lack of training and lack of career motivation of the medical officers, the resulting picture of base facilities, sanitation and civil engineering support is bleak indeed.

The Air Force had no hospitals of its own in either Japan or Korea as the war began. The first two dedicated facilities, built in August 1950 at Haneda and Misawa Air Bases (AB), had 15 beds each; all other hospitalized patients were in medical facilities of the Army or Navy, and some U.S. fliers were supported by Australian flight surgeons (Charles E. Bartels, Col USAF [Ret.], personal communication to DRJ, 15 Jan 2001).

Later the USAF built a 50-bed hospital at Itazuke AB and acquired the Army hospitals at Nagoya and Tachikawa ABs in Japan, and on Johnson Island, a total of 1300 beds for sick and wounded Air Force members, and for military family members on a space-available basis (Wilson, 1960, p. 14). The Air Force also built fixed or semi-fixed hospitals at Kunsan (K-8), Suwon (K-13), Osan (K-55), and Kimpo (K-14) airfields.[48] Most other bases received medical support from dispensaries with few if any inpatient beds. Some facilities furnished medical support to the new Republic of Korea Air Force, and gave in-house

[48] The fluid nature of the war and the tendency of Americans to confuse Korean names led to a system in which each base and facility received a K-number for positive identification. These numbers remain in use in almost every source of information about the Korean War.

training to some of its flight surgeons (Wilson, 1960, pp. 15ff). The Fifth Air Force surgeon reported the medical facilities in Japan as "entirely adequate," but mentioned many difficulties in building them in South Korea, especially since each was individually designed, with no standard plans. He recommended that the Air Force develop standard portable packaged hospitals and outpatient dispensaries for use under future deployment conditions (Wilson, 1960, p. 17).

The problems of supplies and equipment matched those of the facilities. The Army provided most initial medical logistical support. The Air Force experienced misunderstandings about its own system. For example, only one of three arriving B-29 squadrons brought with it the required fly-away kit containing a 30-day supply of medical supplies. The depot system in Japan could not fill medical supply deficits at first, and FEAF medical authorities stressed that flying units from squadrons, wings or groups that moved from base to base, especially from Japan to Korea, should take a one-month supply of medical necessities with them. Flight surgeons were instructed to consider the facilities at the receiving base, the climate, the season of the year and the prevailing health hazards, and to give advance notice to that base of their needs for the following months so that the procurement process could begin immediately. This was essential, since some deploying units had to borrow their supplies from those units staying behind in Japan, causing considerable shortages and delayed replacements to the donor units (Wilson, 1960, p. 26). Such detailed logistical planning presented a considerable challenge for a first lieutenant flight surgeon with only a few months of military service.

Preventive medical problems in Korea included "low standards of individual and community hygiene, venereal disease, the ubiquity of arthropod vectors of disease, and the high prevalence of tuberculosis among natives." After the first summer of fighting in Korea, the FEAF surgeon soon concluded that the most important medical lesson learned was the need for broad and intensive training of all troops in field sanitation and personal hygiene. He reported that the Air Force troops were "babes in the woods" in their understanding of how to live, eat, sleep and work under field conditions in a primitive culture. They seemed careless about mess hall sanitation, waste disposal, protection against disease vectors, or skin hygiene. He noted the failure of the Air Force to train its medical personnel properly since World War II, ascribing this to acute medical shortages. Military supervision and training of locally hired food handlers received special criticism (Kelly FC, cited in Wilson, 1960, p. 28).

Despite the potential epidemiological problems from lax sanitary practices, Air Force non-effectiveness rates in Korea were about the same as elsewhere in the Far East. The lack of severe problems may have been due to headquarters support of preventive medicine and public health measures as the Air Force developed its Korean bases over the next two years. Upper respiratory infections comprised the leading cause of time lost from duty (24%), followed by 22% each for infectious and parasitic diseases and for disorders of the eye, ear, nose and throat, and 11% for venereal diseases, mainly gonorrhea and chancroid. (Note that some patients had more than one diagnosis.) Organized athletics proved impossible as a source of physical exercise due to short supplies of water for showers and scarce athletic equipment (Wilson, 1960, p. 32).

The ongoing shortage of experienced flight surgeons led to some specific problems. Most flight surgeons supported more than one squadron, which diminished their personal effectiveness. At some bases, general medical officers (GMOs) assumed some flight surgeon duties under flight surgeon supervision, a system that proved satisfactory. Some unit commanders reported that these doctors developed into excellent flight surgeons, at times better than the regularly assigned flight surgeons (Wilson, 1960, pp. 28-34). No data are available, but one may speculate that these men had volunteered for a duty that they found more attractive than being a GMO, and thus worked harder at it.

In many cases, newly assigned flight surgeons knew little about their fliers' personal equipment. Some of these flight surgeons were new to flight medicine, and others had come from base hospital duty where they had no chance to become familiar with such matters (Wilson, 1960, p. 33). Other flight surgeons, though, became involved in teaching their fliers and support troops about hygienic matters. They also taught fliers about use of personal equipment, especially oxygen systems and g-suits, and the use of ejection systems and survival equipment. Some flight surgeons compared the effectiveness of various immersion suits by personally testing them in the Han River in wintertime. The introduction of the newer high-performance jet fighters such as the F-86 made this training essential to mission success. Since the various models of jet aircraft differed widely in size, flight surgeons experimented with and proposed different methods of packing dinghies, paddles, radios and other life support and survival equipment (Wilson, 1960, p. 33):

> "Aeromedical research suffered from an acute shortage of qualified Flight Surgeons. Although the investigation of all problems which might adversely affect the health, efficiency, or safety of flying personnel was the responsibility of each unit's Flight Surgeon, such activities were severely curtailed by the lack of a sufficient number of either Aviation Medical Examiners or Flight Surgeons" (Wilson, 1960, p. 34).

The Air Force had relearned several old lessons. Flight surgeon duties extend beyond primary medical care of their airmen to matters of preventive medicine, occupational medicine, military medicine, public health, sanitation, morale, and other matters not generally taught in medical school. They must also serve as staff officers to their unit commanders. Flight surgeons in command of local medical facilities have the responsibilities of any USAF commander, and must be prepared to act in that capacity under combat conditions.

Robert Jay Lifton,[49] a young psychiatrist assigned to the Fifth Air Force, wrote a remarkable analysis of flight surgeon functions in Korea (Lifton, 1953). He noted that aircrew morale, enthusiasm and performance had been generally high because of their training, love of flying, strong group feeling and knowledge of a definite combat tour policy (100 missions). Some reactivated reserve pilots, particularly former multiengine aviators with WW II combat experience who were recent jet fighter school graduates, were not comfortable with

[49] Lifton's observations about fliers and flight surgeons, as scholarly and perceptive as those of the authors of the Macy reports that we reviewed in the chapter on World War II, have been largely overlooked in the aeromedical literature. He went on to become a respected academic psychiatrist and author at Yale, well known in later years for his strong views about the cruelty of war (e.g., Lifton, 1985).

their new roles and were susceptible to anxiety reactions at first. Everyday flight surgeon contact with these and other aviators in mess halls, barracks and on the flight line contributed to their morale, and allowed flight surgeons to detect fliers who were denying their feelings and perhaps developing somatic symptoms instead. Each contact could serve:

> ...as a barometer of group feeling and a means of strengthening his [the flight surgeon's] relationship with the men. He must give freely of himself and exhibit less reserve than is customary in many branches of military medicine, yet he must avoid the pitfall of loss of objectivity through overidentification with the men of his unit. He must realize that his job is medical care in which he makes decisions to the best of his skill and experience. He is not responsible for the fact that men must kill and themselves risk death. The feeling that a flight surgeon recently expressed to me illustrates this clearly. He said, "I have a patient whom I can't get off [the ground]. If he were to be killed, I'd feel responsible." This is certainly an understandable human reaction, but recognizing its illogical content is helpful in making objective medical decisions as indicated. Another flight surgeon recently gave the most meaningful description I have heard of what he did in his squadron. He compared his work to that of a general practitioner, adding, "I'm a half preacher, half doctor, and half psychiatrist, trouble shooter, and general good fellow" (Lifton, 1953).

The paucity of official reports and professional literature about operational flight surgeons prevents a comprehensive assessment of their roles in Korea. Attempts to locate individual flight surgeons who served there led one of the authors (DRJ) to correspondence with an active association of 13th Bomb Squadron fliers who flew in the Korean War, first from Iwakuni Air Base, Japan, and later from Kunsan and Suwon Air Bases (K-8 and K-13) in Korea. Their aircraft were B-26 light bombers. One of the flight surgeons assigned to the squadron's parent 3rd Bomb Wing, Charles A. Cashman, MD, published extracts from letters he had written to his wife Maralea from Japan and Korea.[50] Dr. Cashman confirmed the fliers' ever-present fears of dying in combat and affirmed in strong language the value of his own flights as a combat observer in dealing with those fears:

> One of the most serious problems, which however I have under control, is those individuals who come in and want to be grounded for fear of flying. Their excuses take various forms—they are afraid of low altitude flying, they got airsick on pullouts and evasive action, they have no confidence in the B-26, they would rather fly in [a] heavy bomber such as the B-29, they have aches and pains left over from an aircraft accident, they have other aches and pains that prevent them from flying—any number of things.
>
> Anyway, if you yourself go on some missions they can't come in and "snow you" with a bunch of big hairy war stories. When they start telling you how rough it is you can always grunt, "Yeah—I been." Also they cannot be resentful of me sitting back fat, dumb and happy flying four hours a month [the flying time required to qualify for flight pay]. So after I talk to them for a while and go down with them to talk to their Operations Officer or Executive Officer—they go on and fly. Of course they are afraid, everybody is—unless he is an out and out fool. Nonetheless they go on and do their job, and in flying with them I do mine.
>
> It has paid off. I seem to have the confidence of all the flying personnel and they are not hesitant about coming to me about their problems. They know that they will be grounded if necessary but no longer than necessary[,] and then can go on and get their missions in and go home...I get plenty of, "Hi, Doc"s when I see a bunch of them...I am also invited by a lot of them to go with them (Cashman, 1996).

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[50] These letters appeared in "Invader: the Newsletter of the 13th Bomb Squadron Association." Its editor, William F. Ricketts, Jr., Col USAF (Ret.), corresponded actively with DRJ during the preparation of this paper. We acknowledge and thank him for his help in arranging contacts with Dr. Cashman (now deceased) and Mrs. Cashman, as well as other squadron members cited herein.

Dr. Cashman's letters, written between 8 July 1951 and 5 October 1951 described four of the nine missions he flew with the 13th and 190th Bomb Squadrons. Some were operationally successful, some were not. Most faced flak and small arms fire. He records his observations of the use of personal equipment, the care of pre-flight checks, the attitudes of the crewmembers, their performance under fire, and even some comments about their families—one had learned of the birth of his sixth child just after returning from a mission.

The contrast between the strong public support of servicemen during WW II and the lack of public support for the Korean conflict detracted from morale of the aviators, especially the WW II veterans, as it did for all military members. "They are mature fliers, not the eager flyboys they used to be. A few are bitter and resentful because they have been sent here. These officers are a distracting and a disturbing influence. They seek relief from flying duties by various methods, and develop bizarre complaints and excuses. The chief excuse is an incapacitating fear of flying" (Spiegel, 1953). When such patients presented no demonstrable psychological or psychiatric disease, flight surgeons handled them administratively (Schultze, 1952; Spiegel, 1953).

One report noted that almost all episodes of combat stress reactions occurred in fliers involuntarily recalled to active duty from the reserves, rather than those who were on active duty voluntarily. These reactions rarely occurred in fighter pilots, being more common in aircrew flying fighter-bombers, fighter-interceptors, and other aircraft. The incidence (never specified) diminished as the war progressed, which the author ascribed to better motivation, improved medical and mental health support, and better administrative services. In a memorable phrase, the author concluded by advising supporting medical personnel to "look for gain and guilt" in dealing with fliers with disabling stress reactions (Gatto, 1954, p.1285). Combat psychiatrists restated some of the lessons learned five years earlier. Simple physical and mental fatigue, frequently based on too much work and too little sleep, is a potent etiological factor in combat fatigue. The psychiatric "gain" is not secondary, but is primary and direct: the symptoms can alleviate the underlying cause by removing the flier from the combat cockpit, and one can understand this fact without references to unconscious drives or arcane symbolism.[51]

As always, operational combat physicians faced personal conflicts between wishing to see that the fliers did their duty, and wishing to save them (Lifton, 1953). Flight surgeons on duty in unpleasant circumstances may over-identify with their fliers, saying, in effect, "I can't get myself out, but I can get you out." "It may seem unkind to require further duty of a person who is anxious and uncomfortable, but the greatest...mishandling, and the greatest possible unkindness, is the medical evacuation of a patient who has not yet performed with the degree of honor required of him by both his [conscience] and the community as he sees it, [in] aiding him to burn his bridges behind him and making his guilt irrevocable" (Petersen & Chamberlain, 1952).

Dr. Louis Bauer, already described as one of the founders of aviation medicine, wrote an editorial in the "Journal of Aviation Medicine" citing letters from a Korean War pilot to his

[51] For an example of the way that such a psychoanalytic approach can obscure simple concepts, see Gatto (1954).

wife. The pilot described the pride that kept the fliers going. He wrote of being frightened before a mission, having his fear replaced by the intense activity of the actual flight, and experiencing a mixture of fear and relief after the mission. Fliers did not want to appear afraid in front of their peers, and this pilot described it as "pitiful" when someone "fell out" because of fear. Bauer praised the flight surgeons who supported the brave USAF fliers (Bauer, 1951).

Aeromedical Evacuation

This Technical Report recounts flight surgeon duties in combat situations. Since organized aeromedical evacuation ("air evac") generally involves few operational flight surgeons, and almost never in combat situations, the authors have not undertaken a systematic study of such operations. However, the tactical and geographical conditions of the Korean War forced aeromedical evacuation into a much more prominent role than in WW II, and so a few comments about these developments are appropriate.

In the heat of the opening weeks of the Korean War, Major Charles Peterson, a Medical Service Corps (MSC) officer of the 801st Medical Air Evacuation Squadron (MAES), 315th Air Division, helped establish the first air evac unit at Taegu AB, Korea (K-2) in July 1950. By September, Col Allen D. Smith, the flight surgeon of the Combat Cargo Command, was supervising the evacuation of casualties back to Japan by air (Thompson 1954). The aircraft involved were old C-46, C-47 and C-54 transports, mostly returning from carrying supplies and equipment to the fighting troops. These "reverse airlift" aircraft were configured for general airlift rather than specifically for air evac missions.

As the U.S. Army entered the conflict in force, the uncertain and rapidly changing nature of the battle lines and the poor road system and mountainous Korean terrain made land transportation of masses of wounded both medically and logistically impractical. In place of the old system of litter bearers and field ambulances, light helicopters carried patients from the battlefield to small Mobile Army Surgical Hospital (MASH) hospitals close behind the battle lines.[52] This system provided quicker and more comfortable movement from the point of wounding to lifesaving surgical care. Although initially some Air Force helicopter pilots of the 3rd Air Rescue Squadron were assigned to support MASH operations, Army pilots took over these responsibilities when the two services formally divided aviation duties so that the Air Force flew all but the lightest fixed-wing aircraft, and the Army flew all but a few helicopters.

Once stabilized by the MASH doctors, the wounded were transferred further to the rear. Air Force transports of the 801st MAES flew the patients to Japan where well-equipped and secure permanent Army and Air Force facilities furnished definitive medical, surgical and rehabilitative care. Larger transport aircraft flew patients requiring extensive treatment or prolonged recuperation to hospitals in Hawaii or the U.S. (Apel & Apel 1998, Futrell 1961 pp. 576, 583ff)

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[52] This combination has entered the public consciousness as the subject of the novel, "M*A*S*H" (21), later made into a movie and then adapted to a long-running television series. Physicians "Hawkeye," "Trapper John," "Duke" and "BJ" are recognizable as Berry Planners.

As the system matured, FEAF designated the 801st MAES specifically for air evac missions from Korea to Japan. The squadron configured its aircraft for tactical patient transport, installing medical support equipment and assigning flight nurses and aeromedical technicians to provide expert in-flight care. Other aircraft were designated for the scheduled strategic trans-Pacific aeromedical evacuation flights. The new system resulted in a dramatic fall in fatality rates for the combat casualties and lowered the morbidity in those who survived their initial wounds long enough to enter the system.

During the battle for Seoul that followed the Inchon invasion in September 1950, members of the 801st evacuated 1449 battle casualties from the Suwon and Kimpo airstrips under fire from large concentrations of enemy troops in the surrounding areas. Two aircraft were so badly damaged that they had to be scrapped. From 1-10 December 1950, the 801st undertook the evacuation of the First Marine Division from the area of the Chosin Reservoir near the Yalu River, an air evac operation described by the Medical Department of the U.S. Navy as "one of the most prodigious air evacuations of casualties in military history." The Marines had scratched out two landing strips on soil "frozen harder than concrete" (Wilson, 1960, p. 18). C-47s of the 21st Troop Carrier Squadron, 315th Air Division, carried 801st personnel onto the airstrips where they prepared and loaded the casualties under fire. The C-47s carried an average of 34 patients per flight. "Although many C-47s were hit by small arms fire and one crashed on takeoff, not one patient was injured during this evacuation" (Wilson, 1960, p. 18). The air evacuation of 4689 casualties by the 801st freed up the Marines, allowing them to reach a defensive perimeter on the northeastern Korean seacoast by 11 December. For this action, the 801st MAES received the first Distinguished Unit Citation awarded to a USAF unit in the Korean War. General Harry Armstrong, the Surgeon General, called this action "one of the brightest chapters in the history of our Air Force" (Wilson, 1960, p. 18). In addition to the unit award, 26 air evac personnel received individual awards for bravery in action or for services performed.

The new air evac system—novel, dramatic, humanitarian, effective—naturally attracted attention from the military and from the media. U.S. Vice President Alben W. Barkley, addressing the 1952 annual meeting of the Aero Medical Association, commented, "Last year I made a trip to Korea...to learn what our troops had endured. I had an opportunity to observe the flight surgeons and nurses in the hospitals, on the field and in airplanes as men were brought back to hospitals for immediate treatment from the front lines in 45 minutes. Then they were taken to Japan, and on to Hawaii. ...Ninety percent of the recoveries among fighting men in Korea [were] due to care received on the ground and in the air [by military medical personnel]." (Benford, 1955, p. 261)

Only such general comments remain to describe the role of flight surgeons in these efforts. Flight surgeons were involved in air evac efforts at command levels, and within the transport units whose aircraft off-loaded supplies at logistical aerial ports in Korea and on-loaded patients for the return flights to Japan. Some flight surgeons also may have served at the aeromedical staging facilities that assured the wounded were medically fit to withstand the physiological stresses of the flights, and prepared them and the aircraft for the missions.

Flight surgeons did not routinely fly with the patients but could do so in case of special need.

In the Vietnam War, air evac personnel followed many of the same procedures that their predecessors developed during the Korean War. The modern air evac system retains most of those procedures, refined to meet current situations. This successful process has depended upon analyzing lessons learned during combat operations and passing them on to following generations of air evac personnel. Wilson's preliminary study of the FEAF's Medical Service during Korean War clearly states in its introduction that it "has no body of conclusions at its end, because research is not sufficiently advanced. More historical raw material still exists, and this will be exploited in a later and fuller account" (1960, p. 2).

Wilson apparently never published this "later and fuller account." Nevertheless, in this preliminary 41-page report he includes an explicit list of lessons that FEAF drew from its experiences with aeromedical evacuation. No similar list of lessons learned by FEAF concerning any other field of medical endeavor appears in this document. Wilson offers no comment on why this is so, but cites one specific source for his information.[53] We may speculate that Wilson would have cited similar documents for any lessons learned concerning other areas of USAF medical actions in Korea, especially aeromedical services, had they been analyzed and available.

Reviewing the development of USAF air evac in Korea shows clearly that the procedures developed there have endured to the present day: the lessons were not forgotten. The same cannot be said for the experiences of the flight surgeons assigned to operational units in a combat setting, or for the ways in which their training and assignments were managed by aeromedical authorities. Unreported in official sources or in the aeromedical literature, many of the aeromedical lessons learned in Korea soon disappeared from corporate memory. A later generation of flight surgeons had to learn them again in Vietnam.

Conclusions and Lessons Learned

We have proposed the hypothesis that the professional services provided by flight surgeons have a measurable effect upon the safety, health and effectiveness of flying units in time of war. The 1947 separation of the USAF from the U.S. Army took place during a time of great change in the military posture of the country, including the drawdown after WWII and the retirement of many experienced flight surgeons. The Berlin Airlift and the Korean War both occurred without warning, thus depriving medical authorities of any time for preparation. Undermanned, inexperienced and without the accustomed logistical support of the Army, aeromedical support to USAF units in FEAF was stretched to the point that interservice support, and even support from Australian flight surgeons, became necessary.

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[53] Wilson cites FEAF Headquarters, Office of the Surgeon, Historical Report January-June 1953, pp 12-13, file K-270.740, January-June 1953, 2-6249-1B, RSI, as his source. The authors did not obtain a copy of this report.

Each war is unique, yet all wars share common experiences. The Berlin Airlift and the Korean War reinforced the lessons of World Wars I and II, and added some new lessons as well:

1. *Deployment causes predictable stressors.* The Berlin Airlift gave the Air Force its first experience with mass deployments into operational conditions. The deployment stressors these troops encountered have occurred in every such deployment since then. While current USAF operational plans take into account most of the factors encountered during these early operations, each flight surgeon must expect similar stressors in every future deployment, drawing on past experiences. No plan can anticipate every contingency.

2. *Document significant operations.* Medical experiences were so poorly documented during the Korean War that today it is difficult to put together a coherent picture of the situation. This lack of explicit documentation may serve as an example of the old Air Force saying, "If you didn't write it down, it didn't happen." Responsibility for this shortcoming rests upon the medical commanders of that era, who did not provide for adequate analysis of problems faced and solved, and lessons taught and learned. Korean War experience was thus not available to successive classes of student flight surgeons at USAFSAM.

3. *Think about crew rest as soon as a contingency operation begins.* Working without relief is common during the first few days of any operational military deployment, and flight surgeons should be especially alert for signs of fatigue. Commanders may be caught up in the urgency of the immediate situation, but a schedule of flying days and rest days should be established as soon as possible.

4. *Be alert to safety issues in on- and off-base recreational activities.* Aeromedical and command attention to recreational activities of fliers may contribute to maintaining their availability to fly when on duty by keeping injuries to a minimum.

5. *Plan for family care if any possibility exists that families may appear in the area.* Whenever families can possibly join the fliers, some will do so no matter how stringent the conditions. Medical plans should consider how to support family members who do arrive on the scene.

6. *Provide adequate ancillary medical personnel.* Administrative efficiency of aeromedical programs directly contributes to rapid return of grounded fliers to flight duties. Assignment of insufficient numbers of medical personnel will predictably result in direct and inescapable consequences measurable by crew ineffectiveness and lost duty days.

7. *Train flight surgeons in all aspects of military medicine and officer duties.* Flight surgeon responsibilities extend beyond primary medical care of their airmen to preventive medicine, occupational medicine, military medicine, public health, sanitation, morale, and other matters not generally taught in medical school. These physicians must also serve as staff officers to their unit commanders. Flight surgeons in command of local medical facilities have the responsibilities of any USAF commander, and must be prepared to act in that capacity under combat conditions.

8. *Headquarters must aggressively support inexperienced flight surgeons in the field.* Sometimes a rapid buildup of forces requires the deployment of flight surgeons with little field experience in support of combat operations. Headquarters medical authorities must make frequent command assistance visits to those locations to give guidance until experienced flight surgeons arrive to command and supervise medical support. Assignment of senior flight surgeons should receive the same priority that line officers give to assignment of experienced commanders to flying units in such operations.

9. *Aeromedical evacuation has proven its worth in terms of decreased mortality and morbidity.* Although the present series of reports will not address this topic in depth, one of the great accomplishments of the Korean War was the development of tactical and strategic aeromedical evacuation systems: its lessons were not lost. These systems have continued to the present time, and have been effective in every conflict since that war. Whatever system of analysis and refinement contributed to this accomplishment could be usefully applied to other areas of USAF medical practice.

Many of the lessons listed here had been learned in WWII. Some had endured, some were lost. With time, effective aeromedical support to fliers in the Korean War grew to a level comparable to that of WWII. Operations in Southeast Asia during the Vietnam War gave evidence that such experiences, not recorded for the next generations of combat flight surgeons, had to be learned again, the hard way.

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CHAPTER 4

1959 to 1973: THE VIETNAM WAR AND THE CONTINUING COLD WAR

The Cold War Continues

USAF aircrew experienced new operational stressors as the Cold War progressed. The proliferation of nuclear weapons led the U.S. to adopt the Triad concept of deterrence: underground missiles, nuclear submarine missiles, and airborne weapons. Bomber, tanker and airborne command post crews in the Air Force rotated between flying 24-hour airborne alert missions with code names such as Keen Ax, Chrome Dome and Looking Glass, and standing alert for a week at a time confined in alert facilities on Strategic Air Command (SAC) bases. As the Eisenhower-Dulles strategic Cold War concept of Massive Retaliation gave way to the Kennedy administration's new doctrine of Flexible Response in the mid-1960s, aircraft and aircrew on nuclear alerts expanded to include USAF fighter-bomber crews in North Atlantic Treaty Organization (NATO) nations. Each squadron of Tactical Air Command (TAC) F-100s and F-105s rotated from its U.S. base to a European base for three months out of each year to augment squadrons of the U.S. Air Forces, Europe (USAFE) standing nuclear alert against Soviet targets. In Europe and elsewhere, all-weather flying became a routine training and operational requirement.[54] The USAF assigned some aircrew involuntarily to missile crew duty that included standing 24-hour watches in underground silos. Most aviators found the transition from flying to living in missile "mole holes" intensely demoralizing. In the midst of this era of routine air combat readiness for a Cold War that could become "hot" within a few moments, the slowly escalating war in Southeast Asia (SEA) added a new dimension to service in the USAF. The contrast between flying in the two conditions of war would soon become clear.

1959: The Vietnam War Begins

U.S. involvement in the Vietnam conflict began in 1959 with the in-country assignment of a few military advisors: 342 in 1959, 685 in 1960 (Bowman, 1985, p. 48). The first aircraft loss occurred in 1961 when enemy fire brought down an SC-47 intelligence-gathering aircraft that was flying over the Plain of Jars in Laos. That year, President Kennedy authorized the introduction into SEA of 400 Special Forces troops ("Green Berets") and some temporary duty (TDY) air support, primarily tactical reconnaissance RF-101s and elderly aircraft reconditioned from World War II and Korea: SC-47s, B-26s and T-28 fighter bombers flying in Air Commando operations code-named Farm Gate and Jungle Jim (Bowman, 1985, p. 52ff).

Capt. Theodore C. ("Ted") Dake, Jr. was a pilot-parachutist-flight surgeon with the Air Commandos during this era. Assigned to the USAF Special Air Warfare Center at Eglin

[54] For a graphic description of such duty, see Bach (1963).

AFB, FL, he served on temporary duty with the 1st Air Commando Wing at Udorn Royal Thai AB from 11 August 1964 to 11 January 1965:

> While there, in addition to his Flight Surgeon duties, he [became] a one-man physician ambassador to the natives of the region. In his off-time, he made more than 40 trips to native villages taking medical supplies into remote areas. As a senior pilot and a qualified parachutist, during a shortage of instructor pilots he assisted in the training program of the Asian T-28 pilots and in instruction in the Asian paradrop techniques. In charge of rescue and recovery functions, he developed instructions in controlling steerable chutes for use in para-medical rescue operations (News of members, 1965;36:698).

His commander cited Dake as "...unquestionably the rare one-in-one-hundred who has such outstanding qualities of imagination, enthusiasm and dedication in fulfilling his professional duties" (Aerospace Med 1965;36:698). For his service in SEA, Dake received the Society of USAF Flight Surgeons Malcolm C. Grow Award as the 1965 Flight Surgeon of the Year. Dake later took residency training in psychiatry and completed his USAF career in that field (News of members, 1969,40:1158).

The Air Commando aircraft and their crews represented the forerunners of today's Special Operations forces. This rudimentary military support grew over the next five years to a force of some 500,000 active duty troops serving one-year tours in SEA as the war slowly grew more intense. The approximate number of U.S. military personnel involved in the SEA conflict at the beginning of each year grew from 3200 in 1962 to 23,000 in 1965, 186,000 in 1966, 380,000 in 1967, and 600,000 in 1968. The 1968 total included 500,000 troops in Vietnam itself, a number that grew to a maximum of 543,000 in June 1969. The numbers then declined to 280,000 in 1971, 159,000 in 1972, and 24,000 in 1973. All military personnel had left the country by the end of May 1973 except for a few Marine embassy guards and the Air Attaché staff. U.S. involvement in the war came to a complete close with the helicopter evacuation of about 1000 American civilians and 6000 Vietnamese from Saigon as it fell to the North Vietnamese army on 29-30 April 1975. During the war, the USAF lost 2257 aircraft from combat or operational causes and suffered casualties totaling 2118 dead and 3460 wounded (Berger, 1977, App. IV & V).

The history of the conflict in SEA is long, complex and controversial. It included such events as the unsuccessful communist attacks on all U.S. bases in South Vietnam during the lunar New Year holiday (Tet) in February 1968, and President Lyndon B. Johnson's decision not to seek re-election later that year due to the rising anti-war sentiment in the U.S. Both before and after the 1968 election of President Richard M. Nixon, air war strategy fluctuated in response to political decisions to suspend, resume or modify the bombing of targets in North Vietnam. Political elements of U.S. objectives necessary to end the war began to involve not achieving military victory,[55] but simply negotiating a ceasefire that would allow the release of the U.S. prisoners of war held in Hanoi, to be followed by political discussions. The "Eleven-Day War" bombings of Hanoi and Haiphong in December 1972 provided a means of breaking the deadlock over the Paris peace talks, and the ultimate signing of the resulting peace treaty and the release of the prisoners in February

[55] In a news conference on 11 April 1962, President Kennedy remarked, "We are attempting to help Vietnam maintain its independence and not fall under the domination of the Communists...We cannot desist in Vietnam" (Bowman, 1985, p. 55).

1972 (data from Bowman, 1985). As in the Korean War, the latent threat of attack by the Soviet Union and concern over possible Chinese Communist intervention into Vietnam influenced U.S. political policies, and therefore its military strategy and tactics. These considerations led to covert actions such as incursions into Laos and Cambodia, events that greatly affected Air Force operations but that were never fully supported logistically due to the need for secrecy. Plans for covert actions might or might not include adequate aeromedical support.

Aeromedical Support

The first USAF medical officer sent to South Vietnam was Major W. George Haworth, MC, FS, a residency-trained specialist in aerospace medicine (RAM).[56] Formerly stationed at the USAF Air Force Academy, Haworth was initially detailed to the tri-service American Dispensary operated by the Military Assistance Advisory Group (MAAG) in Saigon. In May 1962, he became commander of the first USAF medical facility in Vietnam, at the Tan Son Nhut Air Base (AB) under the Second Air Division of Thirteenth Air Force (2nd AD of 13th AF), with a staff that quickly grew to include five physicians, a dentist and a veterinarian (Berger, p. 271).

As more Air Force units reached South Vietnam in the early 1960s, the need for local base medical support gradually increased. Col Spencer A. O'Brian, USAF MC, served as Surgeon to the 2nd AD in 1964-65. In an end-of-tour report reminiscent of the Korean War situation, O'Brian noted the assignment of junior medical officers as Directors of Base Medical Services (DBMS) at some bases, pointing out that although they were competent physicians, they were inexperienced in matters of command, public health, and military and medical supply systems. He also wrote of poor radio and telephone communications between USAF medical facilities in Vietnam. Supply was a particular problem because of the rapid build-up, the distance of facilities from supply sources, and the constant shortage of personnel trained in the medical supply system. Medical personnel compensated for their problems by inter-base "borrowing," and by establishing an informal priority system (O'Brian, 1965).

Also repeating its experiences in Korea, the USAF located its first SEA medical facilities in whatever local facilities were available. The host nations in SEA had few suitable buildings, but the Air Force had nothing to deploy. By mid-1966, the USAF had built semi-permanent wooden clinics at some bases (eg, Nha Trang AB)[57] and had begun to deploy modular steel boxes, 40 by 10 feet in size, which could be connected and equipped as medical units (Berger, 1977, p. 273; Nanney, 1995; Powell, 2000). Such modular hospitals replaced the

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[56] The Residency in Aerospace Medicine at the USAF School of Aerospace Medicine (USAFSAM, or "SAM"), had been dubbed the RAM by its faculty and students; the latter termed themselves "SAM RAMs" and instituted a custom of designing distinctive flight suit shoulder patches for each year's class, a system that still prevails. The informal term "RAM" has extended to include all military and civilian flight surgeons who are in such residency training programs, or who are board-eligible or certified specialists in aerospace medicine, and so "RAM" will be used in this paper to denote all such individuals.

[57] Unless otherwise indicated, comments concerning Nha Trang AB come from the personal experience of one of the authors (DRJ).

previous "hootch"-type facilities at Cam Ranh Bay and other bases.[58] Base engineers installed complete modular clinics or hospitals at bases built from the ground up (e.g., Phan Rang, Tuy Hoa, Phu Cat). These modular facilities might have proved adequate for peacetime use in temperate zones. However, the thin walls of the buildings offered no protection against mortar or rocket attacks. Local residents stole the copper plumbing, considered valuable on the black market. The only available replacement, galvanized piping, soon rusted away. Module roofs and ceilings leaked in monsoon rains and deteriorated rapidly in the humid subtropics. Built on the assumption that efficient air conditioning would always be provided, the buildings had few windows and so lacked any alternative means of ventilation when electricity failed or the air conditioning system broke down. (The old French medical facilities used by the Vietnamese included verandas for shade and large windows for ventilation, and though "outdated," were more practical.) Amazingly, the USAF clinic designs made no provision for flight surgeons' offices, waiting areas, or administrative functions (Moser, 1974, p. 17).

USAF policy during the Vietnam era towards its newly drafted physicians was much the same as it had been in Korea. As the young doctors finished internship or the first year of clinical residency, those designated by the Selective Service ("the draft") for USAF service received a form letter asking if they wanted to volunteer to be flight surgeons. Those who volunteered and were physically qualified attended two weeks of officer training at Gunter AFB in Montgomery, AL. Next, they attended the Primary Course in Aerospace Medicine (PCAM) at Brooks AFB in San Antonio, TX. Many then proceeded to SEA, some (but not all) by way of a one-week jungle survival course in the Philippines. The flight surgeons took their initial Air Force flights by transport en route to their assignments (for some, these were their first flights ever!), with their next flights being combat or combat support missions. Many, needless to say, suffered initial airsickness. Most overcame it and served with competence and honor.[59]

The first USAF flying units to reach SEA were accompanied by their own flight surgeons on TDY status. The bases later began to receive physicians directly assigned in Permanent Change of Station (PCS) status. These early flight surgeons wrote almost nothing about their experiences, since most were not career medical officers. Inexperienced junior physicians on one-year combat tours during their two years of military service generally do not record or publish their professional observations. Some of these doctors were new to the Air Force, yet were assigned as DBMSs. As one early 7th AF Surgeon reported, "A combat zone is no place to assign inexperienced 'two-year' medical officers as base surgeons"

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[58] The term "hootch" or "hooch" was the generic name for a 20 by 20 foot structure with wooden walls, partially screened toward the top and covered either with a general purpose (GP)-medium tent top or with Transite (corrugated asbestos composite panels) attached to rafters. Some had sand or dirt floors, while others had flooring of aluminum aircraft pallets or plywood. Such buildings were impossible to keep clean or insect-free, were open to the dust, heat and humidity, and offered no soundproofing against the noises of base aircraft and vehicles.

[59] Of the nine flight surgeons who served with one of the authors (DRJ) during his one-year tour in SEA, only one, a former Naval aviator, had previous flying experience. The other eight were 2-yr flight surgeons new to the service. Three of these left SEA shortly after DRJ arrived, two served throughout his tour, and three arrived as replacements just before his departure. None extended their service beyond their legal obligations.

(Brannon, 1967).[60] Still, some of these young physicians served with distinction, and their accomplishments may be found in news reports in medical journals. Captain Frank W. Berry USAF MC, a flight surgeon on his first operational assignment, flew 25 combat missions as a medical observer in 1965, earning two Air Medals. He received the Airman's Medal for his exemplary courage in helping rescue and treat a Vietnamese pilot who crashed on takeoff in a fully-armed aircraft:

> "Fire fighting personnel were approaching to assist the pilot when shells began to explode, wounding the first fireman. Captain Berry rushed forward [into] this undirected and unpredictable fire to rescue the fireman and render first aid and stabilization treatment prior to evacuation...with complete disregard for his own safety " (News of members, 1966, pp. 338, 758).

During his tour in SEA, Berry, through his own initiative, obtained medications, equipment and supplies for Vietnamese civilians in several villages, and made many trips into unsafe territory (the "Iron Triangle" northeast of Saigon) to provide medical care to patients in a leprosarium. For these and other accomplishments, Berry received the 1966 Malcolm C. Grow Award from the Society of USAF Flight Surgeons as Flight Surgeon of the Year. He went on to enter the aerospace medicine residency in September 1966 (News of members, 1966, pp. 338, 758).

Another young physician, Capt. Robert E. Jackson USAF MC, received significant recognition. Jackson, an Air Commando flight surgeon:

> ...who has experienced the rigors of medical practice in Southeast Asia has [received] the Legion of Merit, the fifth highest award given to U.S. military men...The captain, selected as Tactical Air Command Flight Surgeon of the Year for 1967, had previously earned the Bronze Star, the Air Medal with two Oak Leaf Clusters, and the Joint Services Commendation Medal. ...Soon after joining the military, he requested to serve with the [USAF] Air Commandos... His tour in SEA was a series of emergencies, constantly racing against time, working under somewhat primitive conditions. One such occasion...occurred in August, 1966 when he was treating nine badly wounded soldiers...while he was operating on the last of the wounded men the doctor heard a shot and a cry for help outside his operating room. He put down his surgical tools, ran outside in time to catch his X-ray technician as he was collapsing. The technician had been shot through the chest and was suffering [from hemorrhage and pneumothorax. Jackson decided the situation was beyond his local capabilities and decided to carry the man by air to a better-equipped hospital. The rough flight was made in a small plane at 0100 from a dirt strip lit only by fire pots. During the climb to 10,000 feet for terrain clearance, the pressure change complicated the wounded man's collapsed lung and required the doctor's medical attention.] The climb was rough, and the only lighting available was a flashlight which was held between the doctor's knees... For this action Dr. Jackson was awarded the Airman's Medal. Such a mission was not a rarity. The doctor flew 90 of them involving air rescue, logistical support of ground troops, and medical evacuation. During his Asian tour, Dr. Jackson served in an isolated area located 150 miles from the nearest U.S. military installation. With the aid of one Air Force medic, one native doctor and several locally recruited nurses, he operated a 100 bed hospital. [The article goes on to describe this facility, made of bamboo and local wood, powered by a diesel generator and supplied with locally-purified water.] In addition to treating dysentery, malaria, typhoid fever and malaria, the hospital...cared for civilians and also wounded guerilla fighters, who often required extensive surgery. Even though he contracted a severe case of

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[60] Nha Trang Air Base, a Vietnamese training facility, received the USAF's 14th Air Commando Wing in March 1965. Its first USAF medical support came from one newly trained flight surgeon, an aeromedical technician and two medical technicians. For the first six months of the USAF presence on the base, their "dispensary" was a room in a nearby contract hotel, and their "treatment room" was its bathroom.

malaria while in SEA, Dr. Jackson says his tour there was the most rewarding and gratifying of his entire service career. (News of members, 1968, p. 222)

Unusual and heroic actions by flight surgeons in SEA were not limited to the younger officers. In one of the most widely reported medical incidents of the war, Major General James W. Humphries, Jr., USAF MC CFS, surgically extracted a live rifle grenade from the chest of a Viet Cong soldier under emergency conditions in a sandbagged bunker outside the local hospital (Peyton, 1968, p. 247). Humphries, who had served as a combat surgeon in WWII, was a Fellow of the American College of Surgeons and was Board Certified in Surgery and in Aerospace Medicine. In 1968, he was the Chief of the Public Health Division, Agency for International Development (AID), Department of State. He came to SEA from his position as Commander of the Wilford Hall USAF Medical Center and went on to become Director of Space Medicine at NASA Headquarters in Washington, DC (News of members, 1967, p. 663; 1968, p. 445).

Other flight surgeons participated in similar but less publicized situations. Major Alfred B. Watson, Jr., USAF MC flight surgeon and dispensary commander, participated in a the aeromedical evacuation of a Viet Cong prisoner who had a live rifle grenade lodged in a maxillary sinus. Watson accompanied the patient in an Army helicopter evacuation flight to a nearby Army hospital, where the grenade was safely removed (News of members, 1970, p. 239). Colonel Venedict M. Osetinsky, USAF MC CFS, received a Bronze Star (V) on 14 February 1971 when, while on temporary duty providing aeromedical support to a classified operation, he dodged about 100 yards "through an area of exploding bomblets to a dispensary where he administered surgical treatment to wounded allied troops while the area remained under attack" (News of members, 1971, p. 697). Major Byron T. Johnson, Jr, USAF MC FS, a RAM, received an Oak Leaf Cluster to the Bronze Star Medal for service as a flight surgeon and dispensary commander in Vietnam. He had received his original Bronze Star for his service as an infantry company commander in WW II (News of members, 1968, p. 1033).

After the initial phase of the war, the senior flight surgeon at each facility was usually, but not always, a RAM. In time, a pattern developed whereby one experienced flight surgeon and three or more Berry Plan 2-yr flight surgeons staffed most base medical facilities, sometimes with several general medical officers (GMOs) or partly-trained medical specialists. As the tempo of the war increased and the USAF built its forces, USAF officials so regularly assigned newly graduated RAMs as Directors of Base Medical Services in SEA that these assignments came to be known as "Phase IV" of the three-phase residency. Of the class of 15 RAMs finishing their residencies in July 1967, 8 received assignments to SEA (News of members, 1967, p. 874). Lt. Gen. George E. Shafer, USAF Surgeon General and himself a former 7th AF Surgeon, later commented:

I will say that one thing that saved us was the RAMs. They gave us the capability...of running most of the facilities over there in a knowledgeable way, even though for most of the RAMs that went over, it was their first base-level or management-level function; and they really performed in an outstanding manner (Moser, 1975, p. 13).

Col. Jefferson C. Davis, a Vietnam-era dispensary commander and later Aeromedical Division Vice-Commander, added:

> Some of us didn't think too much of Phase IV of the Residency until we got there and found out...that everything we've been trained for we could use in that area—operational support of the line mission, preventive medicine, occupational medicine, tropical medicine, environmental sanitation, physical standards for the flier, waiver actions—everything that the RAM had trained for (Moser, 1975, p. 13).

Captain Calvin C. Chapman, one of the first RAMs to serve in Vietnam (1965-66), actually completed the preceptorship phase (the third year) of his residency in a combat assignment in Vietnam under the supervision of Col. Hugh W. Randel, the 2nd AD Surgeon.[61] Chapman had an unusual educational background, having first been trained as an industrial engineer. He had worked with the Union Carbide Corporation and with the Boeing Company in civilian life. Joining the Air Force, he served as an engineering project officer for two years before attending medical school in 1955-9. As DBMS at Bien Hoa AB, Chapman became responsible for the medical support of the 2600 men stationed there, and the aeromedical support of operations involving F-100, A-1E, O-1F, U-10, C-47 and C-123 aircraft. He wrote about the "...combat, sanitation and climatic aspects of operations in Vietnam. Medically and militarily, our operation is extremely active. Even on medical evacuation flights using Army helicopters, I've been shot at three times in less than four weeks" (News of members, 1965, pp. 36, 814). He briefed the USAF Surgeon General, Lt. General Richard L. Bohannon, and the Commander of the U.S. Air Force School of Aerospace Medicine (USAFSAM), Col. Harold V. Ellingson, during their staff assistance visits to Bien Hoa (News of members, 1965. p. 1115; Peyton, 1968, p. 247). Chapman was promoted to major during his tour and later received the Legion of Merit for his service in Vietnam, as well as receiving nine Air Medals for meritorious achievements in aerial flights in SEA from 22 July 1965 to May 1966. He was awarded the Purple Heart for injuries received during a Viet Cong mortar attack on the base, and the Julian E. Ward Memorial Award from the Society of USAF Flight Surgeons as the outstanding RAM in 1966. Upon his return from SEA, Chapman became the course supervisor of the Primary Course in Aerospace Medicine at USAFSAM, a position that allowed him to convey his experiences directly to new flight surgeons preparing for the war (News of members, 1967, p. 548).

Major Bruce H. Warren USAF MC SFS, board-certified in aerospace medicine and holder of a PhD in zoology (parasitology), served during this era as Chief of the Aerospace Medicine Division, Research and Development Directorate, Aerospace Medical Division (AMD) at Brooks AFB, Texas, the parent organization of USAFSAM. Warren made two extended TDYs to SEA. During the fall of 1966, he and a RAM, Lt. Col. Fritz Holmstrom, USAF MC, along with flight nurse Maj. Virginia M. Alena, visited the Ninth Aeromedical Evacuation Squadron at Clark AB, Republic of the Philippines, and flew many missions within the Republic of Vietnam (RVN). The team also observed aeromedical evacuation ("air evac") missions between RVN, Clark AB, and Yakota AB, Japan. They evaluated problems on C-141 trans-Pacific air evac flights, including the low humidity during high-altitude flights that adversely affected patients with respiratory and lung diseases, chest injuries and wounds. They made recommendations concerning transport of patients with

[61] The 2nd AD of 13th AF later was redesignated the 7th AF, and Randel became its first Surgeon.

neck fractures in Stryker frames, and the need for developing a self-contained "Special Airborne Medical Care Unit," consisting of a transparent plastic unit to enclose patients who had special medical problems such as contamination.

After Warren and Holmstrom returned to Texas, AMD officials noted early in 1967 that Aerospace Medical Reports from SEA were discussing the need for improved aircrew body armor, especially for those flying the repetitive low-level "Ranch Hand" flights that sprayed defoliants from slow-moving C-123 aircraft. Such flights involved flying a straight-line course only a few hundred feet in the air for as long as six minutes, which exposed the crews to defensive ground fire. The aircrew wore armor developed in WW II and Korea for protection from air-bursting flak. Such armor did not protect the neck or lower head, nor did it cover the fliers' sides. Many crewmembers sat on the armor or on wooden lockers containing the bulky cargo tie-down chains in the mistaken belief that small-arms fire entered aircraft from below. With the encouragement of the AMD Commander, Maj. Gen. Charles H. Roadman, Sr., Warren and Medical Service Corps Major John E. {Jack} Murphy decided to bypass the proper but time-consuming Air Force channels for routine research and development. Analysis of aircrew wounds demonstrated that, contrary to the common opinion of the fliers, the threat came not from directly below, but from oblique bullet trajectories that generated secondary low-velocity missiles within the aircraft. The two men visited body armor experts in the U.S. Army Laboratories at Natick, Mass., and designed an adaptation of Army armor for aircrew use that incorporated ceramic armor with anti-ballistic felt collars and lateral thoracic coverage between the anterior and posterior chest plates.

Warren flew back to Vietnam with three prototype garments in the spring of 1967 and began flying on Ranch Hand missions with those prototypes. He had intended to test them himself, but the crewmembers were so enthusiastic about the new design that they insisted on wearing the prototypes, leaving Warren to wear the older armor in flight. Warren flew test missions in all parts of Vietnam, from the northern Demilitarized Zone (DMZ) to the southern Mekong Delta. On the last planned mission, the flight of three C-123s came under such heavy ground fire that the lead aircraft took eight hits, the middle plane 25, and the last 55. Warren, in the middle plane, received face wounds for which he received the Purple Heart. These wounds might have been prevented had he been wearing the armor he had been sent to test. The USAF quickly approved and distributed the new body armor (Murphy & Warren, 1968). It proved immensely popular and effective not only with C-123 aircrew, but also with those in other low, slow aircraft: forward air controllers, C-7A (Caribou) aircrew, and helicopter fliers. (Personal communications to DRJ from Bruce H. Warren, MD, Col USAF MC [Ret.], 4 October 2001ff, and from John E. "Jack" Murphy, Col USAF MSC [Ret.], 22 October 2001).

Combat, by its nature, produces new aeromedical problems. *The lesson to be learned is that flight surgeons in every war must identify these problems, suggest or develop innovative solutions, and put them into practice.* Headquarters must evaluate and facilitate such solutions with urgency appropriate to the threat. Routine peacetime research channels are not sufficient for the exigencies of situations in which fliers are being wounded or killed each day.

Aeromedical Documentation

FSs assigned to combat units published little information in the open medical literature about their support of fliers in SEA, although they did contribute to the bi-monthly Aerospace Medicine Reports written by the senior flight surgeon at every base in SEA during the war.[62] Four official documents furnish a clear picture of overall aeromedical experiences. The first two are the End-of Tour reports of Col. Earl W. Brannon, Jr., the 7th AF Surgeon in 1966-67, and of Col. Stanley H. Bear, who held the same position in 1967-68. These reports stand out because of their candor and clarity (Brannon, 1967; Bear, 1968).

Brannon, a flight surgeon, was also an experienced orthopedic surgeon. He later commanded the David Grant USAF Medical Center at Travis AFB, CA. During his tour as 7th AF Surgeon, he flew over 100 missions. He received the Bronze Star, the Purple Heart (for wounds incurred on his 65th mission), and four Air Medals, and was promoted to Brigadier General at the conclusion of his SEA tour. An experienced parachutist, he had prior Army service as 82nd Airborne Division Surgeon under then-Col. William C. Westmoreland. Brannon qualified for the Vietnamese Special Forces Parachute Medal while serving in SEA (News of members, 1967, pp. 221, 437, 1305). He was ably assisted in his duties in Vietnam by his Chief of Aeromedical Services, Maj. Louis Cargill, a RAM.

Bear, a senior flight surgeon and specialist in otorhinolaryngology, received glider and parachute training at Fort Benning, Georgia in 1974. He served as a para-rescue physician in Massachusetts and participated in rescue and evacuation of downed aircrew in the Arctic. He later attended Air Rescue Service Survival Schools (Tropical, Desert and Arctic), and made 43 parachute jumps during his career. He received severe injuries in a B-25 crash in 1958, but recovered and went on to become a consultant in otorhinolaryngology to the USAF Surgeon General. While serving as Director of Base Medical Services at the USAF Flight Test Center, Edwards AFB, California, he was responsible for aeromedical aspects of all Bioastronautics Support for Manned Aircraft Systems. He had some 2000 flying hours at the time of his assignment to SEA, as well as earning the Mach II pin for flying at over twice the speed of sound on several occasions (News of members,1965, p. 392).

The third notable document is Col. Royce Moser, Jr.'s report of an aeromedical conference about the war held at USAFSAM in 1975 (Moser, 1975). Moser a RAM, served as DBMS at Phan Rang AB, RVN with distinction, receiving the Bronze Star and three Air Medals, as well as other awards. While at Phan Rang he flew 144 hours as an aeromedical observer, including 99 F-100F missions, with other time accrued in C-123 transports and AC-119 gunships. He returned to USAFSAM to supervise the Primary Course in Aerospace Medicine and the RAM itself. He later became Commander of USAFSAM.

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[62] The U.S. Air Force Historical Research Agency at Maxwell AFB, Alabama, contains many Aerospace Medicine Reports within its archives, as well as the reports of the 7th AF Surgeons and the PACAF Surgeons. These reports contain primary material about day-to-day flying operations, problems faced in aeromedical, medical, public health and sanitation arenas, statistical data on each base, and the names and flying missions of each flight surgeon and aeromedical technician assigned. The current review cites only a few of these documents. Collectively, these Aerospace Medicine Reports comprise a rich source of data for those interested in further information about the activities of flight surgeons during the Vietnam War.

The fourth is Col. Russell B. Rayman's report of a conference of 14 senior flight surgeons, all Vietnam veterans, convened at USAFSAM in 1988 under the auspices of the USAF Surgeon General's Office (Rayman, 1988). Rayman, a RAM, had extensive service in SEA, beginning with multiple TDYs to Thailand and RVN in 1964. He served at Ubon Royal Thai Air Base as flight surgeon to the 433rd Tactical Fighter Squadron, an F-4 unit in 1968-9, and later made multiple TDY visits in 1972-4, including Operations Babylift (rescue of orphans) and New Life (rescue of refugees). He later served as flight surgeon during the Cambodian airlift (see below). His service in SEA resulted in the award of the Legion of Merit with Oak Leaf Cluster (OLC), Meritorious Service Medal with OLC, Joint Service Commendation Medal, Air Medal with three OLC, Air Force Commendation Medal, and Humanitarian Services Medal, along with several unit awards. He flew 59 combat missions over North and South Vietnam, mostly in F-4 fighters and OV-10 forward air control aircraft.

Rayman noted that the young flight surgeons, in their mid-twenties to early thirties, seemed to feel relatively "invincible," and generally were eager to fly missions even beyond the four-hour flying time minimum required of them per month. Most flew 50 to 75 missions during their year at Ubon. They received training in F-4 backseat operations, much of it over enemy territory in Laos, before flying over North Vietnam, and some became so proficient at the new Long Range Navigational (LORAN) system that "they were in demand for flights. In fact, if the flight surgeon was fragged [i.e., on the schedule, a 'fragment' of a larger operational tasking] for a combat mission, [his] medical duties were picked up by somebody else [at the clinic]."[63] Flight surgeons at Ubon lived in hootches with their assigned squadrons, attended all meetings and activities, and took active part in social activities. Rayman wrote that he felt closer to his squadron as a unit than he did to the hospital (Russell C. Rayman, MD, Col USAF MC [Ret.], personal communication to DRJ, 4 October 1999).

As a corollary to the assignment of experienced flight surgeons, several authorities recommended that experienced medical administrators and senior, experienced non-commissioned officers (NCOs) be assigned to positions of greatest responsibility at the outbreak of any hostilities. "[W]hen this staffing did not occur, wartime operations of aeromedical services simply did not give the flying squadrons the very best support." This was not due "to any individual deficiencies, but rather to a lack of experience, knowledge and aeromedical judgment" (Rayman, 1988, p. 12; see also O'Brian, 1965). This was especially noticeable if both the flight surgeon and the administrator were inexperienced: "While we appreciated the need to train our young physicians and administrators, we wonder if we can afford to train both in Vietnam in the same place at the same time (Bear,

[63] During the early years of the Vietnam War, pilots were assigned to both the front and the back seats of the F-4 aircraft. Back-seat pilots (GIBs, "guys-in-back") were not qualified to fly in the front seat during their three- to four-year tours, and were thereby effectively unable to function fully as pilots; they generally detested this duty. Since F-4 GIBs were scarce throughout the USAF, the only way they could shorten their back-seat tours was to serve in SEA, where they could quickly upgrade to the front seat. So many did this that some squadrons had too few GIBs at times, and their commanders regarded flight surgeons who were qualified to fly in the back seat as assets. The overall morale and personnel problem was finally alleviated by replacing back-seat pilots with weapons systems operators (WSOs). These fliers, being navigators, could not upgrade to the front seat (experience of DRJ).

1968, p. 20). Young enlisted personnel sent to SEA, in addition to coping with the other stressors of living and working in a combat zone, had to continue their On the Job Training (OJT) in order to keep pace with their non-combat peers in career progression. The SEA units also had to maintain their training records and reports. This exemplifies how extending peacetime USAF practices into a war zone detracts from combat efficiency in unintended ways, and has been sharply addressed in other USAF career fields (Fox, 1979).

The examples cited here illustrate clearly the difficulties involved in converting a peacetime force into a combat force. Whereas such matters as career development and professional military education are of no particular importance to those who are in the service for a short time, these matters are critical for career military personnel. *The lesson here is that needs for such programs must be balanced against the realities of combat duty, which routinely involve 12-hour days and seven-day weeks, fatiguing duties that make a continuing education program difficult.* This is particularly true for enlisted personnel, such as aeromedical technicians, who may be living in crowded and noisy barracks. Military personnel programs must be responsive to these conflicting priorities, and should have plans in place that allow a service member to dedicate full time to combat or combat support duties without sacrificing long-term career progression. Failure to do so may result in degraded performance of combat-related duties, or may lead to unintended penalties in career progression.[64]

The number of flight surgeons in the Air Force grew from 550 in 1963, before the buildup in forces as the war intensified, to more than 700 in 1971. Flight surgeons represented about 20% of the total physicians in the USAF. The Chief Historian of the Office of the USAF Surgeon General reported that some 110 physicians were among the 1350 or so Air Force medical personnel on duty with the 7th AF in South Vietnam in 1968, the peak of the fighting. Another 350 were assigned to Thailand, where about 25% of the USAF hospital beds were based (Nanney, 1995; Powell, 2000). Altogether, of the 41,000 medical personnel in the Air Force, about 1900 (some 5%) were located in SEA.

Flight Surgeons as Observers on Combat Flights

Flight surgeons flew combat missions in Southeast Asia as observers and, as in previous wars, generally praised the value of these flights. "I think we can all agree, the flight surgeon, in combat or in peacetime, cannot adequately support a flying organization unless he flies the real world missions of that squadron. If he does not understand what they are doing, he cannot make judgments on grounding or on medical disposition or administrative disposition of a flier" (Jefferson C. Davis, quoted in Moser, 1975, p. 5). Establishing a balance between difficulty in obtaining any flying time at all and in restraining those few flight surgeons who spent too much time flying caused some problems. One flight surgeon who had flown about 150 hours in six months was killed in an F-4 flight in 1966. His death

[64] DRJ observed the reverse of this phenomenon during a presentation to the USAF Air Command and Staff College during the Gulf War in 1991. With considerable anger, several fighter pilots offered their perception that, while they were "stuck in school for a year," their peers were flying combat missions in Operation Desert Storm in Southwest Asia and gaining combat experience that would put them far ahead of the students in competition for later promotion.

caused the 7th AF commander, Gen. William Momyer, to restrict flight surgeons from flying in combat altogether. This policy did not take into account that 7th AF had officially classified *all* flights in Vietnam as combat flights, regardless of aircraft type or mission profile, because of the possibility of encountering ground fire on any takeoff or landing.

> This topic [FSs flying combat missions] continues to generate a great deal of discussion at this base [Danang AB, RVN]. Flying activities of assigned flight surgeons are consistent with Para 2-10 of AFM 161-2, as supplemented by sub-command policy. Since all missions flown from DaNang [sic] AB are logged as combat sorties (mission symbol 0-1x), we must either fly combat/combat support or cease flying [in] military aircraft. The element of risk is minimized by prohibition of certain types of missions and adherence to sensible amounts of flying...the Wing Commander and Director of Base Medical Operations each have veto power, and exercise this freely where mature consideration demands conservatism. All flights are voluntary. The flight surgeon must be fully capable of performing his in-flight function without compromise of the safety of flight (Cargill, 31 Aug 1966, p. 4).

These flight surgeon flight restrictions, imposed during the tour of one of the authors (DRJ), were further reported by Brannon (1967). The new policy was widely ignored. Flight surgeon opposition to the new 7th AF policy resulted in a change that allowed each flight surgeon two flights per month, and a later change allowed one flight per week when intense hostile fire was not a significant possibility (Moser, 1975, p. 6). Evolving higher guidance from 7th AF HQ finally allowed flight surgeons to fly with their units as the local commanders saw fit, with the understanding that the more dangerous situations be avoided.

The definition of "unusual risk" in combat operations is situational: a mission deemed highly dangerous at one base might be considered routine at another. Col. Philip E. Steeves, USAF Air National Guard (ANG) MC, reported to Korat Royal Thai Air Force Base (RTAFB), Thailand in September 1972. A licensed private pilot, he had been drafted as a physician and trained as a flight surgeon, serving a year in that capacity in support of transport operations at McGuire AFB, NJ. He volunteered for duty in SEA and was assigned to an F-105G Wild Weasel squadron charged with surface-to-air missile suppression. Previously assigned flight surgeons had not flown combat missions with the unit due to the need for trained personnel to operate the back-seat systems, but Steeves actively sought out training from experienced Electronic Warfare Officers (EWOs) and technical representatives to the point where the squadron considered him qualified to handle its day and night mission requirements. He was not permitted to fly into the hottest areas, but did log about 95 hours of mission time, including 16.5 hours in North Vietnam. A letter from his squadron commander at that time, Edward T. Rock, Col USAF (Ret.), states, "Dr. Steeves was by far the most valuable and effective flight surgeon I served with during my 27 years in the Air Force. His combat experiences and electronics knowledge gained through sheer diligence and perseverance added immeasurably to his credibility in day-to-day dealings with his aircrews." (Cited in Philip Steeves, Col, USAF MC (ANG), personal communication to DRJ, 2001.) Such missions would have been extraordinary in many squadrons, but were flown every day by the 17th Wild Weasel Squadron. Dr. Steeves flew their missions so that he could provide the 17th the same level of flight surgeon participation and support that other squadrons received.

Four flight surgeons were killed in action during 13 years of combat flying in SEA, compared with none in WW I, eight in WW II, and none in Korea. The issue of flight

surgeons flying as observers on combat missions reached the U.S. public on 22 January 1973, just at the end of active U.S. involvement in the war in Vietnam. An article on the front page of the "New York Times" reported that two unnamed military physicians had contacted U.S. Senator Harold E. Hughes (D-Iowa), a member of the Armed Services Committee, about flight surgeons flying as F-4 crewmembers. According to the article, "some of their medical colleagues have actively participated in dozens of bombing raids over Southeast Asia, in violation of international law, military regulations and the Hippocratic Oath." The article cited a number of instances of flight surgeons flying in the back seats of F-4s on missions into North Vietnam and Laos in 1970-72. The report did not mention whether any of these flights were by pilot-physicians, several of whom had been assigned to squadrons as front-seat pilots during this era. Sen. Hughes requested a full investigation from Secretary of Defense Melvin R. Laird (Hersch, 1972).[65] Extensive review of subsequent "New York Times" issues by one of the authors (DRJ) yielded no evidence of any follow-up stories, letters to the editor or other reactions to these "charges." One may speculate that the death of former President Lyndon B. Johnson later the same day, the announcement of the Paris Peace Accords by Secretary of State Henry B. Kissinger the next day, and the signing of those Accords by the combatant nations on 27 January drained any perception of newsworthiness from the affair.

Flight surgeons had been flying as observers on combat missions since the beginning of World War II. Why had this become an issue after so many years? The answer may lie in the changing nature of air warfare. USAF bases in SEA had such diverse flying organizations and missions, staffed by different numbers of flight surgeons, that no single rule about flight surgeon participation in unit missions could cover all situations. Further, for the first time the Air Force had squadrons of high performance jet aircraft—F-4s, F-105Gs—with two cockpits, thus making it possible for flight surgeons to fly on missions unavailable to them in prior wars. Most F-100 squadrons were authorized 16 single-seat F-100Ds and two F-100F two-seat aircraft, used primarily for upgrade training and evaluation flights, but also used in daily combat operations. F-100F back seats had dual aircraft controls but no combat capabilities such as armament radar controls, gun switches or bomb release buttons. Even the old propeller-driven A-1s had side-by-side cockpit seating except for the later –G and –H models.

In contrast, all F-4 aircraft had two seats with dual controls. The rear cockpits contained some equipment essential to navigation and communication, as well as some methods of weapons delivery. The rear cockpit also contained defensive sensory instruments to detect enemy radar and missile lock-on systems. Thus, whereas F-100 or A-1 squadron flight surgeons could fly as observers without actively participating in the mission, F-4 flight surgeons had to become proficient in certain aircraft skills in order to occupy the rear cockpits without degrading mission capability.

A few pilot-physicians served as line pilots, flying full combat tours. Because of such differing aircraft configurations and participation, the line between combatant and non-combatant flying became more difficult to delineate in the Vietnam War than in previous

[65] The author of this article was the Pulitzer Prize-winning journalist Seymour Hersh, who had earlier made public the 260-page secret Army analysis of the My Lai massacre (Bowman, p. 312).

conflicts. A future USAF Surgeon General, Major Edgar R. Anderson, Jr., served as an F-4 pilot-physician at Ubon and Takhli RTABs, Thailand in 1972. He carried the same Identification Card as other pilots. Before his departure for SEA in May 1972, Anderson asked a Judge Advocate General (JAG) officer at Seymour Johnson AFB, SC for an opinion, and was told that such flying was legal because his status had changed from that of a physician to that of a pilot. Initially assigned as a reconnaissance pilot in the RF-4 (in which he would not have had to deliver ordnance), he was reassigned on base orders into a tactical fighter squadron. After 30 missions, he was reassigned from pilot duties at Ubon to serve primarily as a flight surgeon at Takhli when the official reaction to the death of a dental officer in the crash of a forward air control (FAC) aircraft led to a computer search for medical pilots. "[Anderson] flew more missions as a flight surgeon than as a pilot." Finally, due to a pilot shortage at Takhli, Anderson began to fly again as a pilot. He flew approximately 200 hours (97 missions), including air-to-air, air-to-ground and combat air patrol sorties, and received the Distinguished Flying Cross and ten Air Medals. Anderson asked for another legal opinion about such flying in 1980 and was told by a JAG officer at Keesler AFB, Mississippi that the laws had changed, and that such flying would not now be legal (Edgar R. Anderson, Jr., MD, Lt Gen USAF MC (Ret.) personal communication to DRJ, 2001).

Most bases in SEA had one type of aircraft assigned to its primary wing, and other aircraft types assigned to tenant organizations. In order to function effectively, all flight surgeons at each base had to be familiar with each aircraft and its internal layout, crew duties and emergency procedures. Flight surgeons who responded to flight line emergencies had to know what to expect, and how to find their way around the afflicted aircraft, and the flight surgeon on night call had to know about all unit-assigned aircraft on the base. The four flight surgeons at Nha Trang AB, for example, supported 14 different units that flew several types of propeller-driven or rotary-wing aircraft, including four kinds of C-47's (AC-47 gunships, HC-47s with loudspeakers and leaflet chutes for psychological warfare, EC-47s for electronic surveillance, and regular C-47s for transport). The base supported a squadron with smaller psywar planes, single-engine Helio Courier U-10s and twin-engine (push-pull) Super Skymaster O-2Bs, as well as a squadron of 0-1A Birddogs for forward air controllers. The flight line supported C-7A, C-123 and C-130 transports, and two units with planes with no markings, denoting their classified mission status: HC-130s with the Fulton recovery system in evidence on their noses,[66] and C-123s. Two A-1E attack aircraft supported the wing commander and his deputy. One helicopter squadron flew the Air Force's only attack helicopters, armed UH-1Ns. The rescue detachment flew HH-43s, and another helicopter detachment flew HH-53s. Flight surgeons on such bases had to have their helmets modified to accommodate both hot-mike oxygen masks and the boom microphones used on some low-performance aircraft and all of the helicopters. Some aircraft and some missions required that aircrew wear survival vests, and some did not. Some required oxygen

[66] The Fulton system involved dropping a kit to an airman on the ground or in a life raft who would inflate a helium balloon that lifted a nylon cable. The airman would don a harness attached to the cable, the aircraft would snag the upper end of the cable, lifting the airman from the ground and reeling him up by means of a pair of rotating arms that extended forward and outward from the nose of the aircraft. As the airman swung along below the HC-130, crewmembers at the rear would snag the rope and reel him into the rear of the aircraft. This system was successfully tested with sandbags, dummies and two human volunteers, but the authors found no public record of its being used in combat.

equipment, or anti-g suits, or the presence of rifles, or two-way survival radios, or combinations of these items, and the flight surgeons had to know which equipment to use in each aircraft.

Nha Trang's flight surgeons could not associate with fliers assigned to the two units with classified missions, much less fly with them. The confusion that occurred in one of these units on two occasions, a gear-up accident and an aircraft that landed with a wounded man on board, amply demonstrated the consequences of having no flight surgeon with prior clearance or familiarity with unit missions or aircraft (personal experience of DRJ). Major Louis H. Cargill, DBMS at Danang, wrote about this subject:

> There remains what is apparently an unnecessarily lengthy delay in obtaining passes to the command post for flight surgeons and flight medical officers. Since briefings by, and/or for, these physicians are given there, a substantial hindrance to duty exists. Due to the additional delay in obtaining the quite necessary Top Secret security clearance at this installation, it is felt that all physicians programmed for this installation should have the necessary investigations completed prior to leaving CONUS [the Continental United States]. (Cargill, Aerospace Medicine Report, 31 Oct 1967, Danang AB, RVN, p. 4.)

FSs must be operationally qualified in all base aircraft and missions. To provide medical support at the time of their assignment, flight surgeons should have or should receive the security clearances necessary for professional access to all base flying organizations.

A more objective example of the lack of such support may be seen in a personal report of an Air Force pilot who participated in the unsuccessful attempt to extract U.S. prisoners of war from the Son Tay camp in North Vietnam. After graphically describing in nine pages of text his harrowing mission as pilot of an A-1E flying in support of the rescue helicopters, the author concludes:

> Landing at Udorn we were all rushed to debriefing, a building right on the flight line. As I walked in I was met by a group of Intel people with wide grins across their faces and [sic] seemed higher then kites. I thought they were lunatics. They asked "How many prisoners?" I said, "None, the camp was empty." The grins disappeared and their faces turned pale. "What?" I repeated it and thought they were going to pass out.
>
> Once that got squared away debriefing fell apart. People running every which way. I don't remember ever being debriefed and don't think anyone ever was. What preparations had been made to receive prisoners I don't know but they had to be considerable and now were all down the tubes. It was almost a state of panic.
>
> Col. [S] and.... maybe others were whisked off to meet with Gen. [M] at Monkey Mountain, Da Nang. The rest of us were left in the lurch and forgotten about. The sun was coming up by then and we all wandered out onto the ramp. Sat down on the cement cross legged, Indian style, in circles of about ten. Us in our reeking sweat soaked flight suits and the assault force with their blackened faces, guns, grenades and what-have-you hanging off them. They were bleeding from every square inch of exposed skin from dozens of cuts, scrapes and bruises. We all just sat mumbling to each other. No stories were being told. We had all just done it, seen it or heard it and knew what had happened.
>
> Then someone came out and handed a bottle to each of the circles. Everyone took a sip and passed it around and around and around, till it was empty. All of us still just mumbling to ourselves and each other. I can't attest to what was going on at the other circles but there wasn't a dry eye at ours. A tear running down every cheek. A gallant effort with nothing to show. To hell and back for naught.

I want to use the story as an illustration about the way people react to stress...[it] is not a gruesome story, but it is sad. (John Waresh, Lt Col USAF, [Ret.], personal communication to DRJ, 2000)

Although an Army flight surgeon was assigned to the mission and accompanied the participants to Takhli RTAFB for the preparation phase, Waresh does not recall seeing him once the order to accomplish the raid was issued, or after the raiders' return. Waresh's vivid description of the aftermath illustrates a situation where aeromedical support could have helped support the frustrated aviators (and the other participants) in a more structured and possible mentally healthier way.

Flight surgeons have reported the benefits of flying with their units, most using a personal and anecdotal style. One such report was unique in that it was written by a "two-year" Flight Medical Officer (FMO)[67] rather than by a career flight surgeon. Capt. Robert A. Scoville USAF MC FMO had served one year with the Military Airlift Command at Hunter AFB, GA, when he was assigned to Bien Hoa AB, RVN in May 1966. His five-page end-of-tour report went up through channels to Pacific Air Forces (PACAF) headquarters (Scoville, 1967). Scoville received an assignment as flight surgeon to the Third Tactical Fighter Wing, which flew F-100s. He, along with one flight surgeon, three other FMOs and one GMO, provided medical care at the rate of 123 patient visits per day, seven days a week, 24 hours a day. They also provided all preventive, occupational and aeromedical services to the base. Their small dispensary included a six-bed holding unit for minor in-patient care; nearby Army hospitals furnished definitive inpatient services, and further care came via the air evac system to the Air Force hospital at Tan Son Nhut AB or to Clark AB, Philippines:

Early in my tour I learned that if a Flight Medical Officer is to care for his pilots properly, he must know them personally and medically and also be accepted as a trusted member of the squadron. In order to accomplish this, I had to meet the pilot in his own "shop," i.e. his aircraft, his squadron building, parties and other activities...I was constantly amazed at the lack of combat fatigue in these pilots. I believe that motivation is the most important underlying factor preventing fatigue. They are fighter pilots and this is their job...These pilots are proud men; proud of their country, their vocation, and their squadron. Their morale is high (Scoville, 1967).

Scoville went on to describe his work with the pilots, and with a Vietnamese leper colony off base that could be reached only by helicopter. His clinical skills were enhanced by his contact with these 350 patients, who also had tuberculosis, malaria and vitamin deficiencies. During his tour at Bien Hoa, Scoville flew as an aeromedical observer in F-100F, O1-E, AC-47, C-130, C-47, HH-43 and C-123 aircraft, on both combat and combat support missions:

During these missions I was personally able to feel and understand the anxieties and tensions that the aircrew member experiences. Due to this exposure I feel that I can readily recognize pathological

[67] This report has discussed the distinction between the rated flight surgeons, who were authorized by regulation to wear aviator wings on their uniforms, and the designated (unrated) FMOs, who were not. The incongruity of the situation was described in an Aerospace Medical Report from Danang AB, RVN: "The familiar subject of an aeronautical badge [wings] for Flight Medical Officers appears worthy of further consideration at this time. It is indeed difficult to explain to FMOs why their aeronautical designation does not merit "wings" while Flight Nurse designation does. It is also the source of unnecessary confusion among their patients. One superbly effective FMO who has already earned the Distinguished Flying Cross...and the Air Medal with many Oak Leaf Clusters is puzzled by this seemingly remediable disparity" (Cargill, 1966, p. 4).

> anxieties and tensions in these men. Combat flight participation also cultivates the proper Flight Medical Officer-air crewmen relationship. For a Flight Medical Officer to properly carry out his duties, he must know his pilots and other aircrew members. To learn and know these men he must fly with them (Scoville, 1967).

Royce Moser, Jr., MD, MPH, Col USAF MC CFS (Ret.), commanded the 35th USAF Dispensary at Phan Rang AB, RVN from July 1970-July 1971. Correspondence from this experienced and senior flight surgeon reflects observations similar to those Scoville recorded during his tour in 1966-67. Moser asks:

> [W]hy do I advocate combat flying by flight surgeons so strongly? First, it is absolutely essential to participate in such flights in order to build the rapport that is crucial to providing effective aeromedical support. Once pilots recognized that I at least understood their stressors...they more willingly discussed various problems, ranging from personal concerns to concern about an individual with an alcohol problem (that had a good outcome). By flying and living with the crews (we put our flight surgeons in the squadron hootches so we would not lose all physicians with a rocket hit), I also had the opportunity to pick up on human factors problems as volunteered by the crews. For example, one pilot came in after a flight to tell me that he had noticed that his gold key [connection between pilot and ejection seat that allowed instant automatic deployment of the parachute at low altitudes] was hanging loose in flight even though his seat belt was fastened (Moser, personal communication to DRJ, 1 Nov 1999).

Moser goes on to describe how he researched the inadvertent release of the gold key and sent a message to higher headquarters. They responded by saying that they knew about the problem, and that it had been fixed by a modification in the U.S. Moser looked at other aircraft at Phan Rang. He knew that the pilots who flew combat operations carried two pocket radios in their survival vests, not one as in the U.S., and discovered that when the pilot leaned forward to change radio channels, his second radio could move the lap belt handle just enough to release the gold key without opening the lap belt. Moser's tenacity in pursuing this potentially lethal defect resulted in an in-country fix.

In another instance, Moser identified a series of inflight aborts, ascribed either to hypoxia or to oxygen contamination, as being due to hyperventilation. Moser had flown several of the demanding Sky Spot missions, which required precise high-altitude flying for timed-release bombing. He noticed the increased breathing rate of the pilots, which he heard over the "hot mike" intercom system. This was due, not to fear, but to the intense concentration required to fly these precise missions. The resultant hyperventilation had caused symptoms in some pilots that had been confused with possible toxicity.

Moser also reported on the consequences of pilots flying too low to attack ("pressing") the targets:

> ...we were having planes come back with touches of leaf green on their undersides. Having been in the air when we would get urgent calls from troops in contact [with the enemy] for [air] support, I had an idea of what might be involved, and they confirmed that they were so involved in trying to help our guys on the ground that they were pressing. Again, some discussions on "the psychic stresses of combat flying" and the need to recognize the natural tendency to jeopardize yourself and your aircraft helped in resolving the problem. In both the hyperventilation and the pressing situations, I believe the fact that I could describe my own experiences when flying in these situations made a major difference in the effectiveness of my efforts (Moser, personal communication to DRJ, 1 Nov 1999).

As an indication of its regards for his efforts, the 614th Tactical Fighter Squadron voted to have Moser fly in the back seat of an F-100F on the wing's last combat mission.

In 1988, a Working Group of 14 senior flight surgeons who had served (and flown) in SEA considered the issue of flight surgeon combat flying. Their report stated that such flights had historical precedents dating from WW II, and that flight surgeons who flew with their crews would be "far more effective in dealing with individual and squadron problems as well as advising commanders." The Working Group went on to recommend that scheduling such flights be left to local squadron and wing commanders, including number, frequency and specific missions. Flight surgeons should avoid unnecessary risks, which will necessarily vary with the aircraft type, the nature of various missions, and the nature of defensive threats. In high-threat areas, the pilot of a two-place aircraft will want the most skillful aircrew in the second seat; "in such cases, the flight surgeon will probably not be that person" (Rayman, 1988, p. 1). This was the policy later applied in the Air War Over Serbia (AWOS).

Current doctrine about flight surgeons flying is clear:

> The squadron commander or designated representative will ensure individuals receive training to successfully complete unit missions and maintain individual proficiency. The squadron commander will also determine the training level of each assigned crew member, when not prescribed by MAJCOM. Give assigned and attached flight surgeons every opportunity to fly in the unit's primary mission aircraft. Flight surgeons must fly at least 50 % of their annual minimums in primary unit aircraft unless authorized or attached to operational units equipped only with single place aircraft (AFI 11-202, 2000).

Debate about whether and how flight surgeons should fly in combat situations has never ceased, and will undoubtedly continue into future conflicts. The available literature supports the principle that flight surgeons should fly as aeromedical observers with the fliers they support, and the authors of the current review found no professional literature opposing such flying activities. The USAF has delegated authority for decisions in this regard to the commander of the unit to which the flight surgeon is attached for flying purposes (AFI 11-202, 2000). *Flight surgeons are military medical officers who have accepted the risks inherent in their profession, as has the Air Force itself. In peace or in war, whatever aircraft the unit flies, the flight surgeon should fly if cockpits are available and the commander concurs.*

Flight Surgeon Billeting

On many bases, flight surgeons lived in the same quarters as the fliers they supported. This practice had been advocated in previous wars and was generally followed, but not required, in SEA. An end-of-tour report gives an example of the problems faced by AC-47 gunship crews, who flew night missions. These crewmembers, who:

> ...flew 4 out of 5 nights from eight in the evening until six the next morning, were averaging 4 hours of sleep during the day. High temperatures, aircraft noise, building maintenance activities, and sounds from passing vehicles constantly interrupted their rest. Since the average age of these officers was in the 40s, the lack of proper rest aggravated the fatigue factor (Maj. William T. Waldorp, 4th Air Commando Squadron, 1967 end-of-tour report, quoted in Schlight, 1988).

Billeting the flight surgeons with the aircrew brought such problems to aeromedical attention, thus allowing the problem to be worked through both line and medical channels (Brannon, 1967, p. 11). The 1988 Working Group recommended that this policy become mandatory, citing the need for flight surgeons to detect subtle deteriorations in their fliers due to fatigue, minor illness, stress, or demoralization (Rayman, 1988).[68]

Experience in SEA showed that billeting flight surgeons with their fliers had more than an aeromedical value. Sabotage, rocket attacks and sudden guerrilla-style raids could occur at any base and at any time. Dispersing flight surgeons with their various squadrons around the base was more desirable than housing all physicians in one barracks that could be destroyed by a single explosion (Brannon, 1967, p. 7; Cargill, 1966; Rayman, 1988, p. 3; also Royce Moser, MD, MPH, Col USAF MC [Ret.], personal communication to DRJ, 1 November 1999). Such an event later occurred in a car bomb attack on U.S. forces in the Khobar Towers in Saudi Arabia, an unnecessary example of a lesson forgotten.

A less-obvious benefit derived from billeting flight surgeons with their fliers was the attendance of flight surgeons at squadron parties. "These parties were often noted to become not only boisterous, but also in some ways regressive" (Rayman, 1988, p. 4). Some rough party games occasionally resulted in significant injuries: crushing glasses barehanded, squirting people with high-pressure fire hoses, igniting hydrogen-filled balloons with cigarettes. Although such antics were a popular release of tension, the presence of a flight surgeon who could tone the activities down a bit without losing the value of the party itself was obvious. Flight surgeons "should participate in all activities with discretion and when it is appropriate, stand a little aside from the group. This approach will greatly aid the flight surgeon in maintaining the respect and confidence of the squadron that is so necessary in combat" (Rayman, 1988, p. 4).[69]

Improvised Aeromedical Support

Care for fliers detached to remote locations in SEA posed a continuing problem. Forward air controllers (FACs) and psychological warfare personnel flew small, easily maintained single-engine planes (O-1A Birddogs for forward air control, U-10 Helio Couriers for psychological warfare operations). These pilots sometimes lived in remote locations with the ground troops they supported, returning to fixed bases only for aircraft maintenance. The fliers received routine medical care from Army independent medical technicians or non-flight surgeon Army physicians. Some pilots would telephone or radio USAF flight surgeons for medical advice but others undoubtedly did not. One solution for providing them with aeromedical support was the designation of "circuit-riding" flight surgeons who would visit the sites, discuss problems with the local medical staff, become acquainted with

[68] For a detailed description of flight surgeon duties in regard to morale and combat fatigue prevention in fliers, see Jones (1995).

[69] Brannon notes that non-FS physicians may be attached to specific non-flying units such as Security Police and Maintenance Squadrons in a similar fashion and for the same reasons (Brannon, 1967, p. 13). This policy has been undertaken many times, and has always proved beneficial both to the units and to the physicians (experience of DRJ).

the fliers and the missions, and became known as physicians who could be contacted if necessary. This policy worked so well that some dental officers and bioenvironmental engineers took the same approach in providing their own professional support to remote locations (Moser, 1975, p. 8).

The lesson is that a flight surgeon's role in combat extends beyond the office and the flight line into most other aspects of the aviators' lives. Billeting flight surgeons in the same conditions and locations as the fliers enhances professional understanding of their ambience. Providing sufficient aeromedical services to fliers on detached duty at remote locations requires special attention both from local flight surgeons and from higher aeromedical authorities. The headquarters that plans and authorizes such detached duties should not leave to chance the aeromedical support of the fliers involved.

Accounts of improvised aeromedical activities confirmed the opinions of Col. (later Brig Gen.) Richard D. "Hap" Hansen, USAF MC and Lt. Gen. George Shafer that inventive local solutions to unusual or unforeseen problems must be supported at all levels. "The higher we went up the chain of command, the greater the in-fighting, jockeying and chauvinism. We had no difficulties at local level...we went out of our way to see that our Army...or Navy counterparts got equal or better care. *...the workers usually get along pretty well because they have a common job and a common goal, and you're not too worried about who is doing what to whom as long as it gets done*" (Moser, 1975, p. 29-30, emphasis in the original; see also Brannon, 1967, p. 29). One reason for this close cooperation was that many career flight surgeons had friends in similar assignments in other services. These aeromedical specialists had trained together at professional or service schools or courses. Most were also members of the Aerospace Medical Association, and had met at its annual meetings. These personal relationships went far in easing local solutions to professional challenges.

Aeromedical Research in Combat

Imposing peacetime standards on combat operations sometimes caused operational difficulties. One experienced flight surgeon reported an attempt to set up a research protocol during his one-year tour in SEA. By the time the paperwork was approved in Washington, he was within a month of his return, and could not do the work (Russell B. Rayman, MD, MPH, Col USAF MC [Ret.], personal communication to DRJ, 2000). Approval or renewal of routine waivers for fliers in SEA could also take months, during which time the fliers might be administratively grounded and thus unavailable to their units, degrading mission capabilities. Delegation of responsibility to senior flight surgeons at local level was one solution to waiver delays. Shafer commented that local pressure by line officers to influence medical decisions one way or another could exist at all levels of command, and such possible influences could not be avoided by moving aeromedical decisions up the chain of command. "[T]he judgment can be made by the physicians in the area, and you would make no more errors...I realize that somebody might think that if you are in a local area and you are going to be the waiver authority for a flyer, that you might be influenced by your commander or some friend of your commander in the chain of command. But that exists all over. That exists in the Surgeon General's Office... (Quoted in Moser, 1975, p. 27). Hansen also endorsed this concept: "*The senior medical officer on the spot has to have the*

authority to run the show. If he doesn't do it to your satisfaction, then fire him...you've got to trust him." (Quoted in Moser, 1975, p. 27, emphasis in the original.)

Careers in aerospace medicine include interservice contacts during training, professional meetings, short courses, and specific projects. One consequence of these contacts is the forging of personal relationships between flight surgeons of all US military services, as well as between flight surgeons in other nations. Such relationships may prove extremely beneficial during deployment or combat operations, when routine procedures and systems are not able to keep up with the rapid flow of events. Further, precedent shows that unusual responsibilities and authority for decisions may be confidently delegated to trusted associates and subordinates in such situations.

Research programs require careful planning and proper clearance, and such programs are thoroughly regulated by several agencies. Combat conditions may present unforeseen and fleeting opportunities for observational or clinical studies (as opposed to experimental studies). *Medical authorities should provide prior guidance and a rapid protocol for evaluation and clearance of responsible studies.*

Air Rescue Operations

Early in the war, downed aircrew were rescued by whatever helicopters and supporting aircraft were available at the time. The Aerospace Rescue and Recovery Service (ARRS) of the Military Airlift Transport System (MATS, later the Military Airlift Command [MAC]) was responsible for recovery of downed fliers around the world and represented organized USAF rescue efforts in SEA. Its 3rd ARRS Squadron had the task of such recoveries within the combat zone, with detachments at every major air base. In the early 1960s, the only crash/rescue helicopters in the USAF inventory were the slow, short-range (150 knots, 220 miles) HH-43 Kaman Huskies that had been used for local base rescue at U.S. bases for several years. These twin-rotor helicopters had two pilots "up front," and a crew chief/winch operator and an aeromedical technician from the local flight surgeon office in the rear compartment. Flight surgeons frequently flew on HH-43s for familiarization, but received no special training in air rescue operations (experience of DRJ). These aircraft were marginally adequate for combat rescue in jungle operations.

As the war grew, the need for specialized rescue aircraft, devices and personnel became clear. A series of replacement helicopters and aircraft appeared in SEA, beginning with CH-3 single rotor amphibian helicopters. Search and Rescue (SAR) missions became centrally coordinated, and a series of modifications produced HH-3Es, known to aviators as the "Jolly Green Giant." HC-130 aircraft with surface-to-air Fulton recovery systems replaced the older amphibious HU-16s used for rescue at sea. Further development produced the HC-130P for mid-air refueling of the HH-3Es, and then the advanced HH-53 ("Super Jolly"), the largest, fastest and most powerful helicopter in the USAF inventory, which carried three 7.62 miniguns for protection during rescue missions (Berger, 1977, pp. 235ff).
Such aircraft and missions required rescue personnel trained beyond the level of aeromedical technicians from flight surgeon offices. These new pararescuemen, known as

PJs,[70] were supported by a few carefully chosen flight surgeons who were also jump-qualified. The story of these flight surgeo has little documentation, but a few examples may serve to illustrate their innovative sol ions to urgent aeromedical problems.

Captain Clifford J. Buckley, USAF MC FS, had attended the Army Airborne School at Ft. Benning, Georgia. Trained in self-contained underwater breathing apparatus (SCUBA) diving, he had learned the techniques necessary to parachute while wearing full SCUBA gear. Buckley served as the Command Surgeon for the ARRS, and in that capacity made a command assistance visit to PACAF and SEA units in 1966. Based on the needs that he observed during his visit, Buckley designed a new medical jump kit that became standard pararescue equipment. He also instituted a three-fold plan that improved the medical knowledge and proficiency of the PJs. He revised their initial training course, and made personal presentations and gave operational flight training to the PJs assigned to SEA. He flew n all types of missions with the rescue detachments in order to assess their situation: alert me, combat flight conditions, flight safety and other factors. After evaluating the training and technique used at the British Royal Air Force's Far East Survival and Parachute Training School, Buckley adapted the Royal Marines' rapid rappelling techniques to the PJs' operations, thus reducing the helicopter hover time during a rescue to less than one minute. For these and other accomplishments, Buckley received the Malcolm C. Grow Award as the 1967 Flight Surgeon of the Year (News of members, 1967, p. 768). Buckley later took USAF residency training in thoracic surgery.

Capt. William J. Howell, USAF MC FS, demonstrated remarkable coolness under extreme conditions. As reported in the journal "Aerospace Medicine," he:

> ...volunteered for many rescue missions and, although not required, became qualified in the crew duties of the pararescue man in the CH-53 ["Jolly Green Giant"] and HH-43 aircraft. In October, 1972, the helicopter which he accompanied was unable to rescue a Vietnamese Air Force pilot in the South China Sea because of possible swamping from rotor downwash and heavy swells. Capt. Howell had the helicopter land on the beach. He made a raft from a Stokes litter with cut bladders from LPU life vests; then he and a pararescueman swam, towing the raft, about ¾ of a mile to rescue the pilot (News of members, 1973, p. 812).

For these and other feats Howell received the 1973 Malcolm C. Grow Award. A brief notation in the same journal the following year announced the award of the Distinguished Flying Cross to Lt. Col. Gordon Kress Lochridge, USAF MC FS, a RAM, the commander of the 56th USAF Hospital at Nakhon Phanom Royal Thai Air Base (News of members, 1974, p. 227). He flew many rescue missions, and received the Silver Star for a rescue in which, after the gunner was wounded, he manned one of the miniguns in defense of the helicopter as it hoisted a flier out of the jungle (W. M. Runkle, MD, Col USAF MC [Ret.]. personal communication to DRJ, September 2001).[71] Lochridge, now deceased, received many other

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[70] For a vivid and well-photographed description of the duties of PJs, see Sochurek (1968).

[71] This incident may be the basis of an anecdote told to Clements by an unnamed aviator after the war. He described "... one flight surgeon in a search-and-rescue squadron who was required to fly on missions if the downed pilot was thought to have been wounded. After the wounding of his crew chief on the first attempt [to pick up the pilot], he manned the machine gun, rescued the aviator, and won a Silver Star for his valor" (Clements, 1987, p. 26).

decorations and was well known to his peers for his accomplishments in SEA, but no complete account of his service there is available.

Rescue efforts in SEA between 1964 and August 1973 helped save 3883 lives: 926 U.S. Army, 680 Navy, 1201 Air Force, 555 allied military, 476 civilians and 45 unidentified persons. The price was high: 71 U.S. pararescuemen were killed and 45 aircraft lost during the war (Berger, 1977, p. 243).

Medical Civic Action Programs

USAF flight surgeons participated in Medical Civic Action Programs (MEDCAPs)[72] throughout the war, as did their non-flying medical and dental counterparts. Such programs, coordinated with the U.S. Operations Mission and the Vietnamese government, were an integral part of the overall U.S. endeavor to improve the lot of Vietnamese civilians, and medical outreach formed an important part of this effort. For example, Capt. Calvin C. Chapman, the DBMS at Bien Hoa AB near Saigon, spent some of his off-duty time working with patients at the St. Joseph's Leprosarium. This hospital, located in an area 30 miles north of Saigon, was heavily infiltrated by Viet Cong guerrillas and occasionally received fire from Viet Cong forces. Chapman and Col. Harold V. Ellingson, the USAFSAM Commander who was visiting Vietnam to familiarize himself with the aeromedical situation there, came under heavy artillery fire at the Leprosarium in September 1965. They escaped injury, but several buildings were heavily damaged and some patients were wounded (News of members 1965, pp. 1115-6). Lt. Gen. Richard L. Bohannon, the USAF Surgeon General, remarked that this program provided medical and dental care to hundreds of Vietnamese in the villages near the air bases. "You can't begin to estimate how much good [the medical personnel] are doing. They're letting the people know that we are there to help them" (News of members, 1966, p. 334).

Col. Ellingson's visit must have been extensive indeed, providing a vital and useful contribution to the education of student flight surgeons at USAFSAM. His contact with Chapman at Bien Hoa may have led to Chapman's subsequent assignment to USAFSAM in charge of primary flight surgeon training. Ellingson later received an Air Medal for flights that "involved gathering first-hand information for use in the teaching programs of flight medicine courses.... In order to obtain his goal, the colonel participated in flare dropping and cargo delivery missions to isolated Vietnamese stations, and in evacuating patients from remote sites in hostile locations. During his flights, Colonel Ellingson was able to collect valuable pictorial reports which will enhance the teaching programs within the school, and will be of vital interest to Air Force personnel who will serve in Vietnam" (News of members, 1966, pp. 440, 543; Peyton, 1968, p.247). Ellingson, an experienced flight surgeon and a thirty-year USAF veteran with a strong academic background, undertook his fact-finding missions just seven months before his retirement in April 1966. He became President of the American College of Preventive Medicine later in 1965 (News of members, 1965, pp. 1116, 1119) and, after his retirement from the USAF, went on to direct the Aerospace Medical Residency program at Wright State University (News of members, 1966,

[72] For a scholarly, analytic and highly readable introduction to the history, aims, strengths and weaknesses of the MEDCAP program, see Wilensky (2001).

pp. 440, 543). The building housing the Aeromedical Consultation Service at Brooks AFB, TX is named in his honor.

In Thailand, a Civic Action Program of the 606th Air Commando Squadron expanded and reorganized into a Civic Actions Center manned by 84 officers and enlisted personnel, mostly from the USAF Medical Service, and supported by 12 Thai interpreters. This facility treated some 10,000 patients per month. The staff organized a Floating Mekong Medical Clinic to serve the thousands of villagers in that area who were completely isolated during the rainy season; this waterborne facility was coordinated and approved by the Royal Thai government. "The floating clinic proved a great success, was the pride and joy of Air Force and Thai government officials, and greatly benefited the rural people along its route" (Berger, 1977, 292). Capt. Grant B. McNaughton, USAF MC FS, a RAM assigned to the Air Commandos, served almost a full tour in a similar facility. His service in SEA did not concern direct combat support as such, but forms an epic saga of civic action programs (McNaughton, 1974).

Medical Civic Action Programs, formal or informal, have occurred both in peacetime deployments and in combat operations. They not only benefit the patients, but also provide medical participants a respite from their combat support duties, an opportunity to practice a wider range of medicine, and a sense of moral service to balance the horrors of war. *Since MEDCAPs may recur in future aeromedical operations, aeromedical educators may wish to add some formal training in this subject.*

18-29 December 1972: The "Eleven-Day War"

Some background information may help the reader to understand the setting for the extensive use of B-52s, the heavy strategic bombers of the Strategic Air Command (SAC), in North Vietnam near the end of the war in SEA.

Air Force B-52s had flown bombing missions in support of ground operations or in interdiction of enemy supply systems and in tactical situations in South Vietnam throughout most of the war (Operation Arc Light), supported by KC-135 aerial refueling aircraft (Operation Young Tiger). SAC flight crews on TDY from the U.S flew the KC-135s and the B-52s; the latter were based as tenant units at U-Tapao Royal Thai Navy Air Base southeast of Bangkok, Thailand, and at Andersen AB, Guam, a permanent USAF facility. President Lyndon B. Johnson had suspended B-52 raids into North Vietnam on 28 October 1968. President Richard M. Nixon ordered that these raids be resumed on 9 April 1972. More B-52s came to Southeast Asia as the tempo of operations increased. The bombings continued under the code name of Operations Linebacker I and II until the Paris Peace Accords were signed by the US, North Vietnam and South Vietnam on 23 January 1973 (Parks, 1983). The number of B-52s dedicated to operations in SEA quadrupled by mid-1972 for Operation Linebacker I. By December 1972, at the opening of Operation Linebacker II, 206 B-52s were assigned in SEA; Andersen had 53 B-52G and 99 B-52D aircraft, and U-Tapao had 54 B-52Ds (Bowman, 1985, p. 314; Eschmann, 1989, p. 76). This represented about half of SAC's total B-52 force.

B-52 crewmembers were apprehensive as Linebacker II began, and for good reason. The elderly SAC bombers faced the same dangers over North Vietnam as fighter-bombers, but without the maneuverability of the smaller jets. The numbers of fast jet aircraft shot down "up North" bore witness to the effectiveness of North Vietnamese defenses. Although B-52s had been flying sorties over South Vietnam since 1965, the only losses (12 aircraft in eight years) had been to accidents or to midair collisions. Fifteen of the 17 B-52s shot down in 1972 over North Vietnam were lost during Linebacker II. Ten B-52s went down in North Vietnam, four flew into Laos before crashing, and one crashed due to battle damage while attempting to land at U-Tapao RTAFB, Thailand, killing four crewmembers (the other two were rescued at the scene). All these B-52s were hit by surface-to air missiles (SAMs). The losses of aircraft in three countries have led to disparities in the reports of casualties, but comparisons of the listings show that 92 fliers (15 crews of six men each, plus two additional officers flying as command observers) were aboard the 15 B-52s lost. Of these 92 men, 26 were rescued and 33 became POWs, released in February 1973. The remaining 33 were killed or remain missing in action (Bowman, 1985, p. 336; Eschmann, 1989, pp. 176, 203; McCarthy, 1979, p. 172).

B-52s dropped about 15,000 tons of bombs in 724 sorties during Linebacker II (Eschmann, 1989, p. 202). The 15 B-52s downed represented a loss rate of 2.06%, which compared favorably to USAF operational predictions of up to 5% losses. North Vietnamese SAMs and guns brought down 11 other aircraft during the same period. The campaign exhausted the North Vietnamese air defenses; they fired their entire stock of more than 1200 SAMs, and launched only 32 aircraft, of which eight were shot down (two by B-52 gunners) (Berger 1977, p. 95ff, Bowman 1985, p. 333ff). The last two days' B-52 raids were flown essentially without resistance. The North Vietnamese resumed negotiations two weeks after the raids were suspended, with the final terms being settled quickly. In the words of Henry Kissinger, the U.S. negotiator:

> ...there was a deadlock...in the middle of December, and there was a rapid movement when negotiations resumed on January 8. These facts have to be analyzed by each person for himself... (From a press conference on 23 January 1973, cited in McCarthy, 1979, p. 173)

In contrast to the austere facilities of U-Tapao, where the USAF was a tenant on the base of a foreign air force, Andersen AB was an established USAF facility on Guam, built during peacetime. The records of Operations Linebacker I and II provide a unique opportunity to study wartime operations on a permanent base. In addition to caring for crews, flight surgeons treated some wives who were living there as their husbands flew combat missions.

The logistical requirements for the huge influx of bombers and tankers (Operation Bullet Shot), which accelerated in mid-1972 in support of Linebacker I, strained the base to its limits as it military population of 4000 increased to over 12,000 (McCarthy, 1979 p. 12, Moser, 1975, p. 8). In addition, some family members (including at least one child) of the TDY SAC crews were at the local area during the December combat operations over Hanoi and Haiphong, a factor that added extra pressure upon crewmembers (Robert A. Farmer, MD, MPH, Col USAF MC [Ret.], personal communication to DRJ, 2000). According to a SAC commander who served at Andersen during Linebacker operations, "Their [the TDY families'] attempts to compensate for months of TDY separation by sharing a pleasant

tropical Christmas with their husbands had, without any forewarning, become a period of tension and of tragedy." As the losses mounted, the permanent party wives helped to support and comfort the TDY families (McCarthy, 1979, p. 91).

Rayman's report of the meeting of 14 senior flight surgeons after the war commented on the presence of family members in a combat zone:

> At many bases in SEA, it was not uncommon for the families of the aviators to visit for prolonged periods or to actually live near the base for as long as 1 year. Although the Medical Service does not make policy concerning such matters, it was nevertheless observed by flight surgeons that this permissiveness is probably not a healthy thing for all concerned. In many cases it had a negative effect on morale, particularly upon those who did not enjoy the luxury of having their family with them. In a future conflict, this issue will probably have to be addressed again by those in authority. If the Medical Service is consulted, it would probably be best to discourage a policy that allows families in the theater" (Rayman, 1988, p. 6).

Anderson AB had the usual features of a base built to support the many families living there during their sponsors' three-year overseas tours. It was, and may still be, "...one of the most delightful duty stations available. We have a tropical climate, one of the best bases in the world, a reasonable mission, excellent outdoor athletic facilities, and fairly easy access to Japan, Taiwan and Hong Kong for leave" (Farmer, 1973). A permanent Class B Dispensary (clinic) provided local USAF medical care. Robert A. Farmer, Col USAF MC, an experienced RAM, commanded the clinic. He had the additional duty of serving as Eighth Air Force Surgeon. The medical buildup at Guam, coming near the end of the war and occurring at a fixed Air Force facility, presented an opportunity for full exercise of mature aeromedical judgment in preparation for a major combat operation. Farmer wrote several reports about his experiences, and gave a full presentation at an aeromedical meeting after the war. These allow for a more complete examination of the aeromedical support of combat operations than was available from other locations.

In order to accommodate the thousands of incoming TDY personnel, the Air Force built "Tin City" of sheet metal buildings housing some 2700 maintenance and support personnel, complete with latrine and laundry facilities. Later the base created a "Canvas Courts" area by erecting the tents from two Harvest Eagle deployment packages furnished by PACAF. Each tent had a floor constructed from bomb pallets and plywood, electrical connections, and mosquito bars and nets. The Canvas Courts included latrines connected to the base water and sewage systems, with provisions for hot water and nearby laundries. Farmer described the aeromedical role in base design and construction:

> They brought in two of these [Harvest Eagle] kits to house about 2200 men in tents...we had tents initially with grass floors, with coral under that, and they were rather uneven. We got involved in this, medically, from the very beginning. They did not situate a tent or locate a latrine, they did not locate a water faucet or laundry or anything of the kind, without our BEE [bioenvironmental engineer] and our flight surgeon (who was chief of Military Public Health) on the scene participating in the design and location. We thought this was very important, and it played a long-term role in our success in this particular area. We had problems with the tents, not the least of which was that they were very hot during the day. A lot of our people were working night shifts, of course—we were working 24 hours a day, around-the-clock shifts—and they were fairly uncomfortable.

> It happened that the Naval Communication Station had a contract to have several buildings refurbished. We found out about this and negotiated with the Navy that if they would postpone the contract, the Air Force would pay for the penalties involved. We moved quite a number of the people living in tents to this Communications Station (Farmer, cited in Moser, 1975, p. 9).

The small clinic soon became quite crowded. "One often hears physicians and dentists asking if it's their turn to use an office. Storage closets are used for the psychiatrist (he doesn't need an examining table). ...Despite our space limitations, morale remains high, but a sense of humor is an asset" (Farmer, 1973). The details of this operation illustrate a well-orchestrated effort of the entire aeromedical team, including the:

> ...operations at the clinic and the medical service throughout Operation Bullet Shot. We were well staffed prior to [the Operation]. We had a Flight Surgeon's Office with three flight surgeons assigned, the general therapy clinic, a psychiatrist, a pediatrician, a very active dental clinic with several specialists, a vet[erinarian], a BEE—everybody that you need. ... We did get in one additional flight surgeon and two or three [aeromedical technicians]. We changed some of our hours, some of our attitudes...We kept getting larger, though, and in April [1972] with more aircraft coming in, we needed some additional help...[but] we found we didn't have sufficient space for them. ... So we went to shift work. I had 10 medical officers working in the clinic: five of them worked from 0700-1600, three worked from 1600-2300, one worked from 2300-0700, and one was always off because of the number of days he worked. We worked six days a week at this shift work and whenever John finished, Joe took his office. We distributed the workload because we had sick call practically 24 hours around the clock. We adjusted and got the people to come in better for us, but when these troops first started this, they hadn't been accustomed to working six days a week, 12 hours a day, going to work at 0600; *we had to accommodate to them,* and we did quite well (Farmer, quoted in Moser, pp 9-10, emphasis added).

Farmer states a valuable lesson here, one that bears attention. *The medical effort supports the mission of the base, and flight surgeons must tailor their everyday duties to the needs of the military personnel assigned there.* Peacetime routines such as holding a Sick Call only at a specified time have no place in a combat setting. If the base is working around the clock, medical care must be easily available at all hours. An aircraft mechanic getting off work at 2300 who feels ill should not have to wait until the next morning to be seen. Appointments may be made for the convenience of any patient who needs to see a specific physician, but any patient desiring walk-in care must have it easily available.

Anderson AB developed a large population of military personnel living in barracks or tents, some requiring in-patient care from time to time. The U.S. Naval Hospital on Guam furnished definitive inpatient medical care, in which some of the Air Force physicians participated. While the truly ill benefited from full hospital care, some TDY Air Force personnel required only bed rest and time to recuperate from a minor illness or injury. To support the extra workload, the base dispensary added a small area of new construction and received permission to establish an eight-bed ward for limited care of patients with minor illnesses. Farmer described how they provided this less demanding type of care:

> I personally think that more clinics should have some beds. If the Surgeon General's Office or command surgeon [sic] wants to write out some specific guidelines about when they will be used, by whom, and how, etc.; that suits me fine, because I don't want people over there [in the barracks and tents] with bleeding gastric ulcers and diabetic coma. But I think we need the beds because we are still providing at our bases for a few hundred to several thousand unaccompanied male and female airmen, whom I believe are neglected. The airman, when he gets sick, is too sick to go to the barracks, climb up and down the stairs, make his way to the dining hall and back; but he's not sick enough for the U.S. Naval Hospital on

> Guam...But we addressed this; we knew we had the problem. The construction people had just finished to the point that we thought we could accept a part of the new construction...the building that was eventually to become the physical examination center. We took over and put in eight beds; in fact we even had a private room for the ECG room. We worked this way for several months...and eventually we had our own ward...I think we prevented an awful lot of unnecessary loss, men sent home...through this means (Farmer, cited in Moser, pp. 10-11).

Such a primary care facility, however limited, becomes essential when dealing with a large military population living without families. An ill or injured person living in the austere setting of a tent or barracks either must furnish self-care, or must receive care from a friend or co-worker. Without medical personnel to provide observation, food service and some personal care, adequate treatment for an ill or injured individual becomes almost impossible.

Among the 8000 newcomers, some 2000 TDY aviators arrived on Guam, including about 1500 B-52 crewmembers and over 400 reconnaissance, headquarters and staff fliers. The work of the base flight surgeons expanded accordingly:

> After being briefed for the first Linebacker II mission on 18 December, "the first question asked was, 'Sir, for those of us whom the Flight Surgeon has grounded, do you have any objection if we try to talk him into "ungrounding" us?' Such was the morale of the unit. Some [grounded] crewmembers did talk the flight surgeon into letting them fly. Of those, three were later personally cited for heroism and valor in these missions" (McCarthy, p. 45).

> Our flight surgeon spent 90% of his time taking care of the primary crewmembers. We had a fairly high grounding rate—but short-term groundings...You think, I guess, that if you are in a fighter outfit, you get to know the guys fairly well; and you think, contrary, in a big outfit with 1500 guys you don't. This was not our experience, because we flew flight surgeons regularly. They saw the guys fairly often; we got to know them pretty well...

> We participated as flight surgeons in the briefings and the debriefings, and we were just as anxious as everybody else to count the aircraft or to know the number of aircraft that were coming back; those that didn't come back, what happened to them? Had they gone to U-Tapao because they were shot up or had they been shot down? Some were just shot right out of the sky, and we figured most of them, if not all, were KIA [killed in action], but this happened only a few times. A number of crews did bring their aircraft back although the aircraft was counted a loss. There were several very successful bailouts over a friendly territory, and recovery, and I think that [Aerospace Rescue and Recovery Squadron flight surgeon] Kress Lochridge was up at Nakhon Phanom [Royal Thai Air Base, known as "NKP"]. NKP was responsible for a number of our people for a while, picking them up and going out and getting them and taking care of them medically...

> We had a number of guys who would come by just to talk with the flight surgeons for 5 or 10 minutes just to say, 'Here is the way I feel—boy! If I get up there, you talk about tight pucker strings, the SAM starts going.' Well, I guess this is a pretty normal reaction and not unhealthy at all. The guy just needs somebody to talk to, and I think that we served a useful purpose (Farmer, quoted in Moser, p 11).

All the cited reports of Linebacker II note the same demoralizing factor during the first few days of the campaign: the use of common aircraft entry points into and exit points out of the target areas. This factor allowed the North Vietnamese defenses to predict from the flight paths of the first few aircraft where the following aircraft would go, thus allowing for concentrated fire at that point. The B-52 crews were well aware of this, and the fact that the bombers lost some of their anti-SAM electronic capabilities during the post-target turns contributed to their concern. Nine B-52 losses, three on the first day and six on the third,

validated the hazards. Aircrew morale was also lowered by negative comments in the press, and by the fact that their quarters were scattered on and around the base, which made it difficult for the fliers to stay current on which crews had been shot down, or rescued, or had aborted into other bases. In his analysis, McCarthy points out that the extremely complex missions over North Vietnam, which involved intertwining hundreds of aircraft from dozens of locations with multiple midair refuelings, took 42 hours from planning to fruition (McCarty, 1979, pp. 96, 98, 158, 172). Thus, the three days necessary to change tactics were not due to disagreement, but to realistic operational factors and the need for safety. Some of the aircraft commanders flying Linebacker II were new to their responsibilities, and the fact that the intricate changes necessary had to be flown for the first time in combat, rather than in training, gave evidence of their professionalism.

In this context, Farmer reported that flier morale remained generally high throughout Linebacker II, ascribing it in part to feedback about the visible results of the campaign. In response to the mounting B-52 losses, he noted some increased family pressure on the fliers. However, local flight surgeons had little problem with overt fear of flying or refusals to fly. The few overtly anxious fliers responded to conferences with their flight surgeons, commanders or operations officers. Flight surgeons did not accompany any crews over Haiphong or Hanoi, but did participate in flights over other targets (Robert A. Farmer, MD, MPH, Col USAF MC (Ret.), personal communication to DRJ, 2000).

The Paris Peace Accords were signed on 23 January 1973 and became effective five days later, ending USAF combat operations in the Vietnam War except for brief reactions to enemy attacks in Laos in February and in April (Eschmann, 1989, p. 213; Berger, 1977, p.119).

1974-1975: The Cambodian Airlift

Non-combat Air Force operations in SEA continued until 1975. Rayman reported on one of the last U.S. military operations there, the Cambodian Airlift:

> ...until early October 1974, the U.S. Air Force was airlifting food and supplies to Cambodia to help that country withstand...the Khmer Rouge. To reduce the presence of U.S. military personnel in Cambodia, the Air Force...completed negotiations with a civilian contractor to operate...C-130 [aircraft to fly] ammunition and supplies from a base in Thailand to Phnom Penh's Pochentong Airport during the last week of September. As the military situation around Phnom Penh became more critical, the airlift requirement demanded that the aircrewmen fly excessive hours for an indeterminate length of time—a situation, perhaps, reminiscent of the Berlin Airlift. Because fatigue was a potential medical problem, the author was assigned as flight surgeon to the company in order to monitor and observe the crews (Rayman, 1993).[73]

Rayman, an experienced RAM academician, used this opportunity to study the fliers during the most difficult period of their operation, from 13 January to 13 March 1775. He concluded that the variables of such missions preclude rigid limitations on crew duty schedules. These highly motivated and well-paid airmen "could have flown 150-170 h per month indefinitely as long as the mission, mission support, and motivational factors

[73] This article was written soon after the event, and was first published in 1977.

remained unchanged." Rayman recommended that an assigned flight surgeon meet every crewmember before every takeoff and after every landing after the first month of sustained operations. In surveillance for unsafe levels of fatigue, the flight surgeon should:

1. Have daily contact with crewmembers
2. Use anonymous questionnaires to look for trends that indicate declining morale or performance
3. Talk frequently with the fliers about avoiding or minimizing fatigue
4. Ensure that aircrew have the best available quarters, wholesome food, and good inflight provisions
5. Establish good rapport with aircrew and their supervisors (Rayman, 1993).

Rayman went on to state that the decision to ground a flier because of fatigue should be made jointly by the flight surgeon, the flier and the commander or operations officer, because such a decision increases the burden placed on the other fliers. Fliers should also be relieved of all extra or additional duties (eg, awards officer, bond officer, education officer) so that their attention can be devoted to the mission. Authorities should try to avoid changes in the flying schedule, takeoff delays and excessive ramp time. Quarters should be near enough to the flight line that crew rest time is not expended in driving back and forth (Rayman, 1993).

Rayman's article is one of the very few peer-reviewed reports of aeromedical support to combat operations from this era. His published report exemplifies a lesson: *experienced flight surgeons should put their experiences and lessons learned into print for the benefit of their successors, and for aeromedical authorities at headquarters to encourage and support such research.*

Aeromedical Evacuation

As in Korea, aeromedical evacuation ("air evac") divided naturally into two phases. The first phase, battlefield rescue and recovery, remained the main responsibility of the U.S. Army, whose UH-1B "Huey" helicopters flying such missions became immortalized by their call-sign, "Dust-Off." Only one percent of U.S. military personnel wounded in SEA died after reaching a military facility. This represented a considerable improvement over the Korean War, where only 15% of the casualties received helicopter evacuation and the hospital mortality rate was 2.5%. In WW II, with essentially no helicopter evacuation, the hospital mortality rate of the wounded had been 4.5% (Dorland & Nanney, 1983).[74]

Lt. Col. (later Major General) Spurgeon H. Neel, Jr. USA MC, FS, the first U.S. Army RAM, was a driving force behind the Army's Dust-Off evacuation system (Kirby, 2001). Neel helped develop this concept in the Korean War, as we have seen, and brought it to maturity during two tours in Vietnam. Eminently qualified in all aspects of operational

[74] Medical and surgical treatment of the wounded advanced considerably between 1942 and the Vietnam War, and such innovations as the use of frozen whole blood and blood volume machines, artificial kidneys, ultrasonic detection of missile fragments, vascular surgical techniques and aggressive antibiotic therapy also contributed to the progressive drop in mortality. Still, rapid evacuation and early definitive treatment remain the basic principles of care of the wounded.

military medicine, he had been an instructor at USAFSAM before the Vietnam war and went on to a long and distinguished career in the U.S. Army and in academic aerospace medicine (viz., News of members, 1966, p. 658). He trained hundreds of flight surgeons and RAMs during his years on active duty and after his retirement. Neel, who died in 2003, remains an eminent figure in military medicine and in aerospace medicine, honored by his peers around the world.

Once stabilized at rear or central medical facilities, Army vehicles transported patients to USAF Casualty Staging Flight (CSF) facilities to await the second phase, tactical or strategic airlift within the theater. Opportune airlift by tactical C-123s and C-130s accomplished this in-theater transport early in the war, but responsibility for all air evac quickly shifted to the Ninth Aeromedical Evacuation Squadron, which had detachments throughout SEA. This unit was later designated as a Group (Berger, 1977, p. 277).

The wounded flew to Clark Air Base in the Republic of the Philippines, or by C-135 transport on to Japan, Hawaii, or the CONUS for longer care and recuperation. C-141 Starlifter transports soon replaced the older C-135s, providing long-distance movement of up to 60 litter or 100 ambulatory patients (or some combination of both) at high speeds, making strategic aeromedical airlift much more responsive than in previous wars. Ordinary transport planes, equipped with litters and medical service modules, flew most of the war's tactical air evac missions between in-theater bases. C-9A Nightingale aircraft entered the USAF inventory in 1968. Dedicated specifically to air evac, these aircraft only came into use in Vietnam in 1972, late in the war (Dorland & Nanney, 1983; Powell, 2000). C-141s flew about 6000 air evac missions during the war, and overall the Military Airlift Command evacuated 406,022 patients, including 168,832 battle casualties between 1965 and 1973, accomplishing this feat with a perfect safety record (Berger, 1977, pp. 277ff).

Although the air evac system as a whole deserved and received great praise, it needed constant attention, especially at base level. The interchange between Army fixed medical facilities such as large field hospitals and the actual loading of patients onto aircraft presented ongoing challenges. As in Korea, USAF flight surgeons in the combat theater contributed to the air evac process mainly through evaluating and clearing the wounded for entry into the system. Flight surgeons did not routinely fly on air evac teams with the flight nurses and technicians. In theory, patients scheduled for air evac would be moved from Army hospitals to Air Force CSF facilities near the aircraft loading area. The patients would be held at the CSF and treated medically as necessary until boarded (ambulatory patients) or loaded (litter patients) onto aircraft, and then cared for during the flight by the flight nurses and technicians.

The process was supposedly "seamless," but patient flow could be disrupted by late arrivals or rescheduling of aircraft, bad weather, crowded facilities, shifting of priorities according to severity of wounds, and prolonged waits in litters (either in ambulances or lying on the ramp itself) beside the aircraft. Patients could be offloaded and reloaded up to seven or eight times at intermediate stops as new patients were on-loaded during multi-stop missions.

One problem was that some medical officers, including flight surgeons, did not realize that air evac patients came under medical jurisdiction rather than airlift jurisdiction. This led to insufficient medical monitoring of the patient flow process at the base level, and flight surgeons did not assert their authority as would have been appropriate (Lt. Gen. George S. Shafer USAF MC, comments during panel discussion at USAFSAM Operational Course in Aerospace Medicine, 7 February 1974, notes taken by DRJ). A local report furnishes examples of problems with on-site management of air evac patients:

> Flights are presently scheduled to Clark AB on Tuesday, Thursday, and Saturday; to Japan-CONUS on Wednesday, Friday and Sunday, and to Cam Ranh Bay [at 475-beds, the largest USAF facility in RVN] on Wednesday, Friday and Sunday. Ideally, patients going to Japan-CONUS would go out on the C-141 flights and those going to other West-PAC [Western Pacific] facilities would go out on the Clark AB flights. Actually, most patients must be sent out on the *next available flight* [italics added] because the CSF does not have the beds, personnel, and operating room facilities to care for the seriously ill patients more than a few hours. A seriously ill patient is thus subjected to additional litter movements and actually arrives in CONUS later than the less seriously ill, who can be held another night to go directly to CONUS. The very seriously ill patients [VSIs] must bypass the CSF and are taken directly to the aircraft by helicopter from the originating facilities. Therefore, there have been as many as ten patients loaded in the C-141 via the helicopter route, with virtually every C-141 receiving some by this route. This causes a shuffling of patients and multiple movements of litters at the aircraft that is less than desirable. Inserting 10 patients into the flow of patients from the ambus [ambulance bus] to the C-141, practically necessitates placing the VSI's on the ramp by the C-141, and then carrying them aboard as their turn comes to be loaded. The availability of helicopters is not such that patients can be held indefinitely aboard the helicopter. They must be off-loaded to an ambulance, ambus, or the ramp by the C-141 (Cargill, 1967).

Among the problems generating such situations were the intermittent overcrowding of Army medical facilities due to heavy fighting and increased casualties. As patients moved into and through the air evac system, they shifted from Army or Marine jurisdiction to air evac jurisdiction. Some flight surgeons did not understand this process to be a physician responsibility and deferred medical decisions to the Medical Service Corps officers and flight nurses who operated the air evac system. Remote command was also a problem. Although the Military Airlift Command headquarters at Scott AFB, Illinois, controlled the world-wide air evac system, the Ninth Aeromedical Evacuation Group reported to the PACAF Surgeon at Hickam AFB, Hawaii. "General Momyer [7th AF Commander in Saigon] never realized he didn't have control [of the air evac system]" (Shafer, panel discussion, 1974). Finally, the sheer volume of patients contributed to the difficulty of giving meticulous medical attention to continuity of care of individual patients.[75] During March-April 1967, the period of the report cited above, the 22nd CSF at Danang staged 2258 patients onto 84 flights (Cargill,1967).

The lesson was that flight surgeons should remain aware of their responsibilities to the Aeromedical Evacuation system at base level. Detailed management of the air evac process requires the constant attention of senior medical officers, in addition to the logistical and professional expertise of Medical Service Corps and flight nurse officers, so that patient safety and comfort may be carefully balanced against the exigencies of aircraft scheduling and flight safety.

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[75] For one soldier's moving account of his experiences in being wounded and entering the medical evacuation, treatment and rehabilitation process, see Downs (1985).

Repatriation of Prisoners of War

Navy Lieutenant (j.g.) Everett Alvarez parachuted to safety from his jet fighter after North Vietnamese anti-aircraft fire shot it down on 5 August 1964. Fracturing his back during a shallow water landing, he was quickly captured, becoming the first U.S. flier to be taken prisoner in the war. Alvarez was held prisoner for nine years (Bowman, 1985, pp. 84; 338). Such losses became unfortunately common as the war progressed; the Communist forces captured some 600 U.S airmen.[76] Flight surgeons became accustomed to supporting units that lost fliers, and later published this comment on the process:

> A common occurrence in SEA was the death or the capture of airmen by the enemy. By and large, squadrons were able to handle this very well individually and as a group probably because most were somewhat accustomed to losing a squadron mate because of peacetime crashes. It was noted that many of the airmen, upon losing a friend, would invoke a number of defense mechanisms to cope with this tragedy by commenting, "he was a dumb jerk," "he made a mistake I would never make," or more fatalistically, "he was hit by the golden BB" [i.e., hit by a random shot. Fliers in former wars referred to this phenomenon as "the bullet with your name on it"]. On the other hand, many airmen undoubtedly grieved very deeply at the loss of a close friend in combat. In any event, flight surgeons can help the squadron cope with the tragedy by encouraging commanders to have some sort of a closing event; for example, a memorial service or some such ceremony where the lost pilot's coffee mug is broken. Anything symbolic like this will draw a line between the past and the future and for some reason it appears to have a beneficial effect on the entire squadron (Rayman, 1988, p. 6).[77]

Plans for the release and repatriation of prisoners of war (POWs) were first codenamed Project Egress Recap, and later Operation Homecoming. In 1968, the Department of Defense (DOD) had directed that each repatriated U.S. military prisoner of war (RPW) would enter medical channels immediately upon release and would remain in patient status until he had completed all post-captivity processing at a hospital in the Continental United States (CONUS). The plans were refined in 1969 and again just before the mass release of Operation Homecoming in February 1973. A "rehearsal" of the final plan occurred in September 1972 when three prisoners were released (Johnson, 1974). In accordance with the conditions of the Paris Peace Accords, the North Vietnamese released 651 prisoners in three groups between 12 and 27 February 1973. As planned, USAF flight surgeons played a key role in the repatriation of the POWs. Primary responsibility for carrying out the aeromedical aspects of Operation Homecoming lay with the Ninth Aeromedical Evacuation Group at Clark Air Base, Republic of the Philippines, which was commanded by an experienced RAM, Leonard W. Johnson, Jr., Col USAF MC (News of members, 1972, p. 694). Clark USAF Hospital, commanded by Lt. Col. John W. Ord, USAF MC FS, was selected as the receiving hospital for the POWs, with initial medical responsibility for evaluation, diagnosis and treatment (News of members, 1973, p. 818). Ord later received the Legion of Merit for his work in directing the medical aspects of Operation Homecoming; the Clark Hospital received the Outstanding Unit Award (News of members, 1974, p. 112).

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[76] Because some who parachuted safely into communist-held territories later were classified as Missing In Action (MIA), and others died in captivity without being reported as captured, the exact number who were held prisoner is not known.

[77] For a discussion of the emotional reactions of fliers to squadron losses, see Jones (1982).

As the end of the war approached, some authorities made unrealistically dire predictions about the supposedly debilitated mental conditi[illegible]f the prisoners in Hanoi based upon data from such long-term captives as imprisoned co[illegible]s, Holocaust victims, and "brainwashed" Army enlisted personnel captured in Korea. F[illegible]mple, "Tangible changes in the appearance and demeanor of the returning POWs should, of course, be expected, and they cannot fully be addressed or counteracted in the period immediately following repatriation" (Segal, 1973). Apparently, no one sought out the data from a truly comparable demographic group, the fliers shot down and imprisoned in previous wars.

Seven Air Force, three Army and six Navy residents in aerospace medicine, along with two other senior flight surgeons, flew as flight surgeons on the C-141 missions that carried the RPWs from the Hanoi airport to Clark AB (Phase I of the repatriation). These physicians, along with several other flight surgeons, flew on the subsequent aeromedical evacuation missions that flew the RPWs from Clark to Hawaii and thence to their destination hospitals in CONUS (Phase II):

> The duties of these flight surgeons included reviewing all available [prisoner of war] medical information; evaluating the conditions of returnees at the pickup points to assure their ability to be transported by air; passing clinical information ahead to the JHRC [Joint Homecoming Reception Center at Clark AB); re-evaluating the men prior to their flight to CONUS; administering medical care inflight as required; and establishing physician-patient and flight surgeon-flier rapport with each returnee (Johnson, 1974).

The 18 flight surgeons chosen to accompany the RPWs collectively flew some 3000 hours during 52 days. The 16 RAMs among these flight surgeons, representing the USAF, Army and Navy, prepared an unpublished joint report.[78] It notes that placing the RPWs in patient status proved a wise decision, since it allowed them the necessary medical evaluations and care, shielded them from the public eye, allowed some privacy for reunions with family members, and insured that their personal wishes could be met without undue external pressures.

Having RAMs escort these RPWs stands in contrast to previous policies. After the Korean War, mental health professionals met the returnees, mainly Army enlisted troops. These escorts later used psychiatric terminology to describe their "patients" as confused, unenthusiastic, dazed and defensive. Treating people as if they are psychiatric patients strongly influences their behavior, a phenomenon well known to those who deal with combat fatigue victims (Jones, 1995). The opinion of the RAMs during the 1973 repatriation was that the returning fliers would likely have manifested "a degree of caution and unenthusiastic reaction" if they had been met by psychiatrists and psychologists, instead of meeting with their familiar medical advisors, experienced flight surgeons (RAMs, "Aeromedical Support of Operation Homecoming," unpublished report, 1973).

Medical planning for repatriation included pre-placement of a flight surgeon-cardiologist with proper medical equipment on the ground in Hanoi on the day of release of one RPW reported to have had previous possible myocardial infarction with angina, arrhythmias and syncope during the episode. Several airborne clinical possibilities justified having two flight

[78] "Aeromedical Support of Project Homecoming," a 20-page typed draft annotated by one of the authors but unsigned and undated, was probably written in 1973. A copy is in the possession of DRJ.

surgeons on board each aircraft: cardiovascular arrest causing diversion to an unscheduled landing while resuscitation was underway; acute exacerbation of malaria, increased anxiety as the RPWs neared home, and the presence of unknown medical conditions due to illness or injury in some of the men. "Flight surgeons helped insure that the health and personal welfare of the returnees remained the primary consideration during all phases of the operation" (Johnson, 1974).

Predictions of the medical and mental conditions of these RPWs had been based on similar experiences in previous wars,[79] and on conditions of the dozen or so men released earlier from Hanoi in groups of three. In fact, most of the prisoners repatriated from Hanoi were in reasonably good health, and their morale was high.[80] This appears to have been because most were fliers and thus were older than most ground troops. Most POWs in previous wars were enlisted troops in their early 20s; this corresponded to the average age of POWs taken on the ground in South Vietnam (mainly U.S. Army troops), reported as approximately 19-21. The average age of the RPWs from Hanoi, who were mainly fliers, was about 31 (Wetzler, 1979). Almost all the U.S. military prisoners in Hanoi were educated and highly motivated career officers. While in prison, they had established the Fourth Allied POW Wing (U.S. fliers taken prisoner in WW I, WW II and Korea were considered to have been the first three wings). This organization had an intact chain of command, a dependable means of communication through various coded means, and a sense of discipline, mission and honor that sustained them through years of uncertainty, torture and deprivation (Jones, 1980). The 16 RAMs later reported that associating with the RPWs during their repatriation was very similar to associating with military fliers under ordinary circumstances, and that the RPWs responded in familiar ways to their new surroundings:

> The Senior Ranking Officer among the prisoners retained his authority over them even during their repatriation flights. The RPWs were not certain that the North Vietnamese were not planning some sort of "trick," and remained repressed and quiet until they were airborne. As they adjusted to the "rapid flux of new experiences, they frequently sought support in the form of medication or from the flight surgeon." They were surprised at the extent and warmth of their welcome at Clark AB.
>
> Significant stress was noted in the group as a whole as they approached their return to CONUS. The older RPWs discussed the stress, the middle-aged seemed to feel there would be no problems, and the younger did not discuss it. There was some feeling that CONUS itself threatened the group integrity that had sustained them for so long. This is a strong reason to keep such a group together as long as possible in the repatriation process. The fact that the flight to CONUS was aeromedical meant that the flight surgeon had authority for decisions, not the Public Relations or escort officers. This assured that the welfare of the RPWs was the primary consideration.
>
> Prior medical information about the prisoners appeared to have been classified and was therefore not available to the physicians who were to treat them. All RPWs were aware of their infestations with

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[79] The Veterans Administration published a study of the medical care given under similar circumstances to the POWs from WWII (European and Pacific Theaters) and Korea. Senior RPWs from Vietnam contributed to this study, including Lt Gen John P. Flynn, Chairman of the Advisory Committee on Former Prisoners of War, and Everett Alvarez, Jr., then the Deputy Administrators of Veteran Affairs. The reader who seeks further information on these matters is referred to this authoritative document, which contains an excellent bibliography up to its date of publication (VA, 1980).

[80] For a detailed account of Operation Homecoming, along with photographs that illustrate the conditions of captivity and the appearance, good spirits and excellent morale of the RPWs, see Berger, 1977, pp. 321-339.

intestinal parasites, and expressed concern about transmitting them to family members. Immediate treatment was reassuring, but caused some inflight diarrhea.

The excitement of the situation led some RPWs not to sleep for up to 72 hours. This, plus the circadian disruption of the flight home, led to some symptoms that required medication. Anxiety was noted in the fliers' agitation and an intense desire to talk. "This syndrome was again managed by the close personal support of the flight surgeon," along with occasional sedative medication.

The RPWs appreciated the flight surgeon support, and the flight surgeons found that the RPWs related better to the flight surgeons who had accompanied them to Clark during Phase I and worked with them there than to flight surgeons who arrived solely to accompany them from Clark back to the CONUS during Phase II. "If at all possible, flight surgeon staffing should allow at least one from the original pickup crew to stay with the returnees" all the way home.

Finally, medical plans called for RPWs to receive only basic treatment at Clark in order to return to CONUS as quickly as possible. Some of the RPWs expressed concern that they had not received more extensive and definitive treatment at Clark. The flight surgeons believed that most RPWs in such situations would choose to be fully free of parasites and to be assured that they did not have tuberculosis or other communicable disorders before returning to their homes. "Aside from those rare family emergency situations, the medical staff can feel no pressure to hasten the return to CONUS. An added point here is to confirm the wisdom [of] first bringing returnees to a geographically remote hospital...the returnees voiced the need for this time to take care of personal needs and to readjust somewhat to freedom before meeting families." [Lessons paraphrased or directly quoted from *Aeromedical Support of Project Homecoming*, unpublished report, 1973.]

Several organized meetings took place in later years, attended by RPWs from WW II, Korea and Vietnam as well as by medical and mental health authorities. These meetings expressed other valuable lessons that should be available if similar situations arise in the future:

If possible, assign a personal escort officer to each returnee. An experienced flight surgeon should be assigned to each group of returnees. The escort officers and the flight surgeon should accompany this group from the point of repatriation until the RPWs have reached their final destinations in the CONUS.

- Be cautious in re-introducing RPWs to alcohol, which may exacerbate beriberi and cause vomiting and syncope.
- Establish the RPWs as patients, and emphasize their medical status to all persons who will meet them, specifically including commanders, officials and VIPs at enroute stops. This clear delineation of authority will lessen the chance of inter-agency conflicts during the repatriation process, allow for more control over the role of the media, and clarify such mundane matters as whether the RPWs are to wear pajamas or uniforms (some had to change back and forth four or five times between Clark AB and their final destination).
- Assign an experienced senior clinician, rather than a group of sub-specialists, to oversee inpatient medical workups of RPWs.
- Discourage clinicians from initiating personal research projects involving the RPWs. "Since most staff members in a medical care facility will have had little experience in performing research, the likelihood of such a project having real scientific merit is likely to be slim."
- RPWs have personal interests that their clinicians should consider. These include:
    - Effects of medical test results upon planned service careers and flying status
    - Effects of remaining on flying status upon subsequent disability claims
    - Priorities of family matters (time of reunion, marital relationships)
    - Psychological needs such as privacy, guilt, anger (direct and displaced)
    - Relationships with other RPWs, both in support and in conflict
    - Opinions about publicity during repatriation (Data from an unpublished draft report submitted in 1985 to the VA by Jones DR, "Health Care Evaluation Upon Repatriation.")

The receiving medical facility acts as a buffer from intrusions by VIPs (political, military and even medical), media, and even premature reunions with family members, should such a buffer be necessary. RPWs may be worried about possible infectious or contagious diseases, and flight surgeons may address these concerns. The time spent in medical evaluation also allows time for re-entry into the world from which the RPW was cut off by captivity, an experience that can be overwhelming if it occurs too swiftly.

While many of these matters transcend routine flight surgeon duties, the repatriation experiences after the Vietnam War demonstrated that experienced flight surgeons were the best prepared among medical personnel to serve in their traditional role as medical mediators for the fliers who had been RPWs, and were well accepted by these fliers.

1973: The Vietnam War Ends

Col. Richard D. (Hap) Hansen, USAF MC CFS, a RAM, served as the last 7th AF Surgeon in Vietnam, and was reported in 1973 to be the last USAF physician to leave that country. He received the Legion of Merit, the Air Medal with Oak Leaf Cluster, and two Vietnamese military awards. His subsequent assignment, fittingly, was as the Chief of the Education Division at USAFSAM (News of members, 1973, p. 985).

Early in 1945, the U.S. Army undertook a survey of 2700 fliers of the 2nd Air Force to determine their opinions about the effectiveness of the support furnished by their flight surgeons to mission effectiveness and safety, which this report cited at the end of the section on World War II (Aeromed Lab, 1945). The USAF does not appear to have conducted any such formal review of its flight surgeon program in Vietnam. In 1987, a RAM, Col. Thomas I. Clements, MC USA, surveyed 35 USAF fliers who had served in Vietnam concerning their flight surgeons' expertise in medical and military matters, teaching and interpersonal relations. The author acknowledged the many limitations of his survey. These included the subjective nature of his interviews, the small number of fliers, their possible biases (all the fliers were currently undergoing aeromedical evaluations at USAFSAM), the diversity of their combat assignments and experiences, the long interval between those experiences and the interviews, and the anecdotal nature of their responses. Thus, he drew no statistical conclusions. He simply summarized the basic nature of the responses:

Table I. Comments by Vietnam era interviewees regarding flight surgeons

Comment	No Comment	Positive Comment	Negative Comment	Suggestion for better service
Medical expertise	10	22	2	1
Military expertise	9	18	5	3
Instruction expertise	25	9	0	1
Interpersonal relations	9	16	6	4

(Adapted from Clements, 1987)

Clements concluded that flight surgeons serving in Vietnam between 1964 and 1973 were generally highly regarded by their aircrew. These high opinions, formed when the fliers were much younger, had endured. Now that the fliers were relatively senior officers, they had a more mature idea of the role of a proficient flight surgeon in combat. Their basis for positive comments came chiefly from the feeling that they were treated by highly competent physicians who would take care of them when the need arose. They felt that the physicians were below standards in military bearing, but were considerably more "military" than were non-flight surgeons; this view did not detract from the fliers' positive opinions about their flight surgeons. "Interpersonal relationships were a high-value item throughout the whole [flying] unit. The sense of trust in the flight surgeon (his medical abilities, his abilities to use the system, etc.) was most clearly related to this item" (Clements, 1987).

The most pervasive negative element detracting from the survey was the number of fliers who simply could recall nothing about their flight surgeons, and thus had no comment on the factors being studied. Now, as senior officers, they were aware of this gap in their experience, and felt that the combat mission could have been enhanced by the active presence of a flight surgeon. Clements felt that the need to establish this presence should be emphasized to future flight surgeons, their educators and supervisors, and to future line officers (Clements, 1987, p. 33). The authors of the current report emphasize this last point: *clearly, these matters should also be a part of the professional training of USAF line officers.*

Conclusions and Lessons Learned

Many of the aeromedical lessons learned during the war in Vietnam recapitulated those of World War II and Korea. The experience in SEA also revealed some patterns that were not so apparent in those wars:

1. *Adapt peacetime training programs and career progression issues to the realities of combat operations.* This report illustrates only a few of the difficulties involved in converting a peacetime force into a combat force. Troops who plan a service career have different needs from those who plan to leave the service, regardless of their occupation. Whereas such matters as career development and professional military education are of little importance for those who are in the service for a short time, they are critical for career military personnel. In combat operations, continuing education programs compete with the realities of fatiguing combat duties that routinely involve twelve-hour days and seven-day weeks. This is particularly true for enlisted personnel, such as aeromedical technicians, who may live in crowded and noisy barracks or tents. Military personnel programs must be responsive to these conflicting priorities, and should have plans in place that allow a service member to dedicate full time to combat or combat support duties without sacrificing long-term career progression. Failure to do so may result either in degraded performance in the combat zone, or in unintended penalties in career progression.

2. *Flight surgeons must fly with their units.* Flight surgeons are military medical officers who accept the risks inherent in their profession, as does the Air Force itself. Whatever aircraft the unit flies, the flight surgeon should fly if cockpits are available. Line

headquarters should establish a clear policy actively *mandating* such flights and delegating the authority and responsibility for them to the unit line commander, with the concurrence of the senior flight surgeon who serves on his/her staff. The debate about whether and how flight surgeons should fly in combat situations came to the fore during the Vietnam War. This discussion has never ceased, and will undoubtedly continue in future conflicts. The basic principle is that flight surgeons should fly with the fliers they support. The USAF has delegated authority for decisions in this regard to the commander of the unit to which the flight surgeon is attached for flying purposes (AFI 11-202), and the final decision about when the flight surgeon should fly rests with that commander and with the DBMS. Because of the variety of aircraft and missions involved in combat operations today, decisions *limiting* the flight surgeon role in flying as an observer on combat missions should be based upon legal opinions from qualified sources at the highest level.

3. *At least one flight surgeon at each base must be operationally qualified in each aircraft and mission at that base before arriving there.* To provide medical support as soon as he/she is assigned to a unit, a flight surgeon should have or receive the specific training and security clearances necessary for professional access to that unit prior to arriving on the base. To delay this process until arrival is to deprive that unit of the complete range of aeromedical support to which it is entitled by regulation, and to delay the effectiveness of the flight surgeon concerned until on-site training is complete.

4. *Billet flight surgeons with their aircrew.* A flight surgeon's role in combat extends beyond the office and the flight line into all aspects of the ambience of the aviators. Billeting flight surgeons in the same conditions and locations as the fliers enhances professional understanding of this ambience.

5. *Provide sufficient aeromedical services to fliers on detached duty at remote locations.* This matter requires special attention both from local flight surgeons and from the headquarters that plans and authorizes such detached duties. Headquarters should not leave aeromedical support of detached duty fliers to chance or to local improvisation.

6. *Encourage and facilitate interservice contacts among Army, Navy and USAF flight surgeons during training courses, professional meetings, continuing education courses and specific projects.* Such contacts forge personal relationships between flight surgeons of all US military services, as well as between flight surgeons in other nations. These relationships may prove extremely beneficial during deployment or combat operations, when routine procedures and systems are not able to keep up with the rapid flow of events.

7. *Delegate authority for aeromedical decisions such as waivers to field medical officers.* The performance of USAF flight surgeons in combat operations demonstrates that responsibilities and authority for aeromedical decisions ordinarily made by major air command surgeons or the USAF Surgeon General may be confidently delegated to trusted associates and subordinates. This greatly reduces time lost by individual fliers in the combat zone, and allows qualified local aeromedical authorities to decide which complex aeromedical decisions should be passed up the chain of command.

8. *Develop procedures to expedite assessment and approval for research projects in the combat zone.* Peacetime medical research programs require careful planning, proper clearances and lengthy, extensive coordination. As shown by the experiences of Warren and Rayman, combat conditions may present unforeseen and fleeting opportunities for clinical studies (as opposed to experimental studies), or for accelerated research and development of necessary items. Medical authorities should provide prior guidance and have ready for combat contingencies a rapid system of evaluation and clearance for responsible studies.

9. *Plan for Medical Civic Action Programs during combat deployments or operations.* Formal or informal MEDCAPs have occurred throughout recent military medical operations both in peacetime deployments and in combat operations. Since MEDCAPs will undoubtedly recur in future aeromedical operations, aeromedical educators should add some formal training in this subject to course curricula.

10. *Tailor medical support of combat personnel to their needs.* All medical personnel, including flight surgeons, must adjust their everyday schedules and duties to the needs of the military personnel assigned to their bases. Peacetime routines such as holding a Sick Call only at a specified time have no place in a combat setting. If the base is working around the clock, medical care must be easily available at all hours.

11. *Provide a few in-clinic patient "holding" beds at every base.* An "in-patient" facility, however limited, is necessary when treating a large military population without families to care for them. Adequate care for an ill or injured individual in a tent or barracks setting without the food service or dedicated observation of a family member is impractical, detracts from the necessary duties of the care-giver, and may be medically hazardous.

12. *Local flight surgeons must watch over local aeromedical evacuation units.* Detailed management of the aeromedical evacuation process requires the constant attention of senior medical officers, in addition to the logistical and professional expertise of flight nurses and Medical Service Corps officers, so that patient safety and comfort may be carefully weighed against the exigencies of aircraft scheduling and flight safety. Management of the air evac system is a complex interdisciplinary and interservice process that becomes a career for some Air Force offices and enlisted personnel. Aeromedical evacuation of sick and wounded within and out of a combat zone demands flexibility from these professionals, augmented by meticulous medical oversight from on-site physicians so that patient care is not sacrificed for logistical needs. Balancing the conflicting priorities of flying operations and patient welfare demands the attention of experienced flight surgeons at all levels.

13. *Fliers held as prisoners of war should be repatriated into an in-patient status under flight surgeon supervision.* While many of the matters involved in repatriation of prisoners of war transcend routine flight surgeon duties, the experience after the Vietnam War demonstrated that, among the medical personnel, experienced flight surgeons were the best prepared to serve in their traditional role as medical mediators for the fliers who had been RPWs, and were well accepted by these fliers. (The flight surgeons who accompanied the prisoners of war during their repatriation in 1973 reported many more lessons. A full list appears on page 111 of this report.)

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CHAPTER 5

1973-1999: THE COLD WAR, ASYMMETRICAL COMBAT AND COUNTER-TERRORISM

1973-1989: The Cold War after the Vietnam War

Public reaction in the U.S. against the Vietnam War led to legislation in the mid-1970s ending Universal Military Training, and with it the Doctor Draft. The ensuing drawdown of forces led to the virtual disappearance of young military physicians from the USAF, including the 2-year flight surgeons. This shortage resulted in several initiatives aimed at maintaining military medical strength. A detailed analysis of these initiatives is beyond the scope of this review, but some notable trends affected the demographics of USAF flight surgeons.

The first trend was toward diversity. From the beginning of aviation in the U.S. military, most flight surgeons had been male U.S.-born junior officers. New policies in the late 1970s actively recruited female and male civilian physicians, offering them substantial cash bonuses and guaranteeing their entry into the service at advanced rank based upon their seniority as medical practitioners rather than their military experience. This program, termed "Pony Express," and other innovations recruited a group of physicians considerably more diverse than the Berry Planners. Many flight surgeons now were older men and women, newly commissioned as majors and lieutenant colonels. A large proportion of these new officers had little or no military experience to go with their rank. Their variety of backgrounds mirrored the growing proportion of foreign medical graduates among U.S. physicians.

The second trend was an active effort to attract physicians into military careers of 20 years or more. During the era of Universal Military Training, the Air Force had been able to assume that the flow of junior primary care medical officers represented a constant and renewable source of practicing physicians. The Medical Corps had made some effort to recruit its 2-year flight surgeons for full careers, but with little success. Now the USAF developed a career track for medical officers that began with undergraduate education at the Air Force Academy or through Reserve Officer Training Corps scholarships at civilian universities, proceeded through medical training at the Uniformed Services University of the Health Sciences or commissioned scholarships at civilian medical schools, and went on to similar residency training programs. This career track continues to this day, so that many medical officers report to their first operational assignment as practicing physicians with 8-12 years of commissioned service in training programs. This may include four years in college and in medical school, plus a year of internship and three or more years of residency training. These physicians are thus obligated to serve many years of active duty to repay their training.

Third, whereas previously Air Force officials had generally refused to permit the expensive practice of allowing line officers, including pilots, to attend medical school while on active duty, this career track became acceptable.[81]

Finally, and perhaps most importantly, in the 1980s USAF Surgeon General Lt. Gen. Paul W. Myers and his staff recognized the need for continued *military* medical training for the entire Medical Service, especially the health care providers. Since the end of the Vietnam War, USAF medical authority had concentrated on training its physicians in medical specialties as a way of attracting career officers. Expanding this policy, Myers decided upon a common core medical training program for both active duty and reserve medical officers, beginning with nine mandatory Medical Red Flag Exercises involving the entire Medical Service. Seven "Red Flags" took place at major medical centers in the U.S., one was held at Ramstein AB in Germany, and one at Clark AB in the Philippines. At each location, an experienced military medical faculty conducted two successive seven-day training periods of classroom training and field exercises. Half of the medical personnel in the area could attend the first week of training, and the other half the second week. Essentially all medical personnel then on active duty attended Medical Red Flag training and exercises; the first and only time the USAF has given such training simultaneously to all its Medical Service officers and senior NCOs (experience of DRJ).

General Myers also supported several new medical combat readiness courses: Battlefield Medicine and Battlefield Nursing at USAFSAM, and the eight-day, tri-service Combat Casualty Care Course ("C-4") and Combat Casualty Management Course ("C-4A") at Fort Sam Houston and Camp Bullis in San Antonio, Texas (Cohen [ed.]. 1993, p. 227). The latter three courses continue to the present time, greatly enhancing USAF medical preparedness for deployment and combat operations. In order to increase their integration into line operational readiness, medical officers are now encouraged to take Air Command and Staff College and Air War College training, a rarity before 1980.

This sustained command emphasis on recruiting, training and maintaining a Medical Corps with not only medical but also combat skills produced a USAF Medical Service with solid military capabilities. This was especially true of the career flight surgeons graduating from the Residency in Aerospace Medicine, the RAMs. About 17 flight surgeons per year have entered this three-year specialty training course even during times of force reduction, a policy that kept aeromedical services at a high professional level in the Active Duty component, the Air National Guard, and the Air Force Reserve.[82] In addition, the Air Force has continued to train a few pilot-physicians each year, maintaining about 14 on active duty at all times (Mapes, 1991).

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[81] One of the authors (RWM) served a tour as a T-38 Instructor Pilot before returning to medical school and postgraduate training. His experience as a pilot has served him well throughout a 30-year career in military psychiatry and aerospace medicine.

[82] For a recent analysis of military preparation of primary care physicians, including flight surgeons, for the practice of deployment medicine in operational situations, see Perkins et al. (2001).

The 1980s: Asymmetrical combat

The changing composition of the flight surgeon corps coincided with a change in the nature of USAF air warfare. From World War I through the Vietnam War, U.S. wars had involved lengthy conventional clashes that included ongoing air-to-air combat between national air forces. As the influence of the Soviet bloc diminished, no single national force emerged as a likely wartime opponent of the United States. Instead, the interests of smaller nations and terrorist groups during the 1980s led to limited military or paramilitary actions that elicited circumscribed but powerful military responses from the U.S. government. "Removing the element of superpower coercion from the affairs of certain nation-states has brought about the collapse of many contrived boundaries drawn after World War II. The resulting demise of ill-conceived nation-states has fast become a trend" (Wettering and Petrie, 1994, p. 17). In response to this new kind of threat, the U.S. undertook a series of armed rapid response actions identified not as declared wars, but as code-named operations; i.e., Urgent Fury, El Dorado Canyon, Just Cause, Desert Storm, and Allied Force. These brief, intense conflicts began a pattern of asymmetrical warfare that reinforced the need for continual USAF medical readiness.

Following a series of terrorist attacks in and around Beirut in the early 1980s, the Lebanese government asked the United States to establish a military presence in Lebanon to serve as a peacekeeping force. Early on 23 October 1983, non-Lebanese terrorists used a truck laden with compressed gas-enhanced explosives to destroy the headquarters of the First Battalion, 8th Marine Division. The explosion and collapse of the building killed 241 U.S. marines, sailors, and soldiers, as well as some 58 French paratroopers (Petit, 1985). Medical teams from the 375th Aeromedical Airlift Wing evacuated the casualties from Beirut to military hospitals in Germany as U.S. Navy and Marine reinforcements steamed toward the Middle East.[83] However, officials in Washington diverted this task force to the Caribbean in response to a new crisis (Burrowes, 1988, p. 74).

October 1983: Grenada—Operation Urgent Fury

Two days after the terrorists destroyed the Marine barracks in Beirut, the United States invaded the island of Grenada. An increasingly aggressive Cuban presence within the Grenadan government had escalated from the construction of a 9000-foot runway to support possible military deployments from Cuba. Local leftist uprisings resulted in the brutal death of Prime Minister Maurice Bishop and the house arrest of British Governor-General Sir Paul Scoon. These and other bloody events led the six-member Organization of Eastern Caribbean States—Dominica, St. Lucia, St. Vincent, Montserrat, St. Kitts-Nevis, Antigua—to vote to intervene militarily in the crisis. The Organization appealed to non-member states Jamaica and Barbados and to the U.S. for assistance (Burrowes, 1988, pp. 77-79; Russell & Mendez, 1985, p. 6). The memory of the 444-day Iranian hostage crisis of 1979-80 was still fresh in Washington, and terrorists had just killed 241 American servicemen in Lebanon. President Reagan expressed concern for the immediate safety of over 1000 American citizens in Grenada, including some 700 students attending local medical schools. The operation, code-named "Urgent Fury," began on 25 October 1983.

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[83] Information obtained from http://www.beirut-memorial.org/history/brochure.html).

Stiff resistance from the Grenadan army and Cuban para-military units on the islands met the initial assault of some 1,200 U.S. troops. Heavy fighting continued for several days, but as the invasion force grew to more than 7,000, the defenders either surrendered or fled into the mountains. The battle was over in less than a week. (Adkin, 1989; Burrowes, 1988, pp.75ff; McConnell, 1991, p.91; Russell & Mendez, 1985, pp.3-12ff). U.S. casualties were 18 killed and 116 wounded; the Cubans lost 25 killed and 50 wounded, and Grenadan losses among irregulars and civilians were 45 dead and 350 wounded (Russell & Mendez, 1985, p. 35).

USAF support to this operation involved heavy aircraft deployed directly from the continental United States—KC-10 mid-air refueling tankers, C-130, C-141 and C-5A transports. Tactical air-to-ground support came from Special Operations AC-130 Spectre gunships (Adkin, 1989, p. 364). Aeromedical support for these units was limited to flight surgeons performing their functions at their home bases. Whatever new challenges they faced were not mentioned in official reports of Urgent Fury. These circumstances, however, represented the beginning of a trend toward USAF operational combat missions originating from permanent bases, as had occurred briefly at Andersen AB, Guam in 1972. When this occurs, aircrew flying the combat sorties each day do so while living with their families. The need for flight surgeon support to families during combat operations, a modern element of U.S. aerial combat operations, has continued to the present.

USAF in-theater medical support of the operation came from the First Aeromedical Evacuation Squadron (1st AES) at Pope AFB, NC, an active duty unit, and from the 31st AES, a USAF Reserve unit at Charleston AFB, South Carolina. Barbados, West Indies, became the aeromedical evacuation ("air evac") forward operating base. Although flight surgeons did not routinely fly on air evac flights, at least three flight surgeons (from Charleston AFB, Pope AFB, North Carolina, and McGuire AFB, New Jersey) did so during this campaign, and under combat conditions:

> Normally, an air evac crew does not include the flight surgeon, but this time, the flight surgeon accompanied the crew in case some of the wounded were unstable. ...The flight stretched to more than an hour as the Hercules [C-130] circled above Point Salines [Grenada] waiting for a break in the fighting...Soon they were on the ground and had the ramp door open. The scene was surrealistic: the runway was huge and it was a totally new place. The crew didn't know where the patients were going to come from and didn't know where to stop. While taxiing, shots could be heard and little puffs of smoke could be seen on the runway, but it didn't seem real.
>
> The plane taxied to the terminal area and boarded two litter patients and one ambulatory patient while the engines continued to run. The Combat Control team told the pilot to move to the end of the runway to off-load medical equipment. Then ground fire intensified, forcing the pilot to taxi out of the area.
>
> As the plane was taxiing out, the air evac crew began to throw boxes of medical supplies out of the plane onto the runway, trying to leave as much as they could, particularly that which they thought was necessary. A truck pulled up next to the aircraft when it was about halfway down the runway and the plane stopped to load more casualties.
>
> The air evac crew worked furiously, too busy to be afraid. To get one casualty, two crew members jumped out of the plane and ran out about 15 feet, oblivious to the dust, noise, chaos, excitement and

action—and to the possibility of being shot. They lifted the litter up quickly; and after running to the plane, which didn't have the ramp down, they jumped back in with the litter.

The crews secured the five patient litters to the C-130 floor, just as they had practiced during the numerous training flights. Soon they were airborne, heading back to Barbados...

One crew flew into Grenada for the first time on the night of October 27, the night of the big attack on Point Calvigny barracks. The fighting could be heard in the background, and the tracers could be seen in the night sky. The crew went to the clearing company...and suddenly they had 12 real, fresh casualties. But they were ready because of their training. (Quinlan, 1984)

Ultimately the air evac crews flew 23 missions, carrying 164 patients. Improvisation was the rule of the day, but "the air crew took these conditions in stride, making a remarkably smooth transition from participating in exercises to the tactical environment. Many of these crews were fresh from the Reforger and Bold Eagle exercises. The ease of the transition underscores the value of continuous and repeated exercise" (Quinlan, 1984).

Although most USAF exercises had supported Army operations:

...the unit also smoothly evacuated wounded being treated by the Navy. On October 31, an air [evac] crew flew from Barbados to the aircraft carrier *USS Independence* to evacuate two critical patients. The crew had never seen a Navy C-1A Cod [Carrier Onboard Delivery aircraft] until the flight between Barbados and the Independence. Nevertheless, while the flight surgeon took patient reports, the air evac crew rigged the airplane to accept two litters. The patients then flew to Barbados and transferred to a waiting C-130. A similar flight was flown November 6....Moving patients from the deck of an aircraft carrier is not part of normal aeromedical evacuation training. Nor is actual combat. (Quinlan, 1984)

In another unusual mission, air evac officials received a call to move 37 casualties from Grenada to the United States:

Since C-141 aircraft were now landing at Grenada, the aeromedical evacuation aircraft with the medical crew from the 31st AES and the flight surgeon were sent directly [from Charleston AFB, SC] to Grenada to pick up casualties. After the casualties, which were not yet stabilized, were emplaned in Grenada and their injuries evaluated, they were evacuated to the Naval Air Station, Roosevelt Roads, Puerto Rico. The eight most seriously injured were deplaned there and taken to the Navy Hospital. The remainder were flown to Pope AFB, North Carolina. (Shy, 1984)

Interservice medical cooperation marked this operation; U.S. Navy flight surgeons also supported Army operations:

Urgent Fury was a success, but not without the inevitable tragedies of battle. People did get hurt and die. In the full light of morning on the first day of the operation, helicopters transported wounded to the *USS Guam.* As the helos landed, teams of hospital corpsmen rushed to help carry stretchers. A triage area was set up in the hangar bay. The ship's doctor, Lt. Dan Walsh, flight surgeons and corpsmen prepared patients for surgery. As the first casualties were taken to sick bay, an Army [twin-engine] UH-60 *Blackhawk* [helicopter] gunship approached *Guam.* The pilot had been shot through the left leg and was bleeding profusely. Anti-aircraft fire had damaged the engine controls. The co-pilot fought the helicopter to the flight deck, but couldn't shut the engines down. Chief Aviation Boatswain's Mate (Hydraulics) Walter Anderson reacted instantly. On his command, a water hose was rushed to the helicopter where a stream of water was directed into the engines' intakes. The rotor blades stopped and two aircrewmen aboard the *Blackhawk* scrambled out, beaming with relief. Hospital corpsmen helped the wounded pilot onto a stretcher. By noon it was obvious to the sailors on *Guam* that the Army, landing at Point Salines, had

encountered the heaviest resistance. All the medevacs up to that point had been Army soldiers. [Information obtained from http://www.history.navy.mil/faqs/faq95-1.htm]

"Rapid response operations are measured in hours or days and have objectives which can be accomplished by surprise or overwhelming force" (Wettering and Petrie, 1994, p. 19). One lesson was clear in Urgent Fury: the rewards of realistic training include flexible and responsive performance under combat conditions, no matter how unexpected or intense. The short notice—two days—between the decision to act and the beginning of the action gave realistic urgency to USAF operational and medical readiness planning. In addition, some combat missions had originated at CONUS bases, an innovation that foreshadowed future "fighting-in-place" operations. Operation Urgent Fury had demonstrated a clear lesson of the post-Cold war era: *all USAF Medical Service personnel, regardless of their base of assignment, must be ready to go to war at any time. Flight surgeons bear a particular responsibility in this regard, since their responsibilities during combat operations may differ considerably from their ordinary duties.* This lesson was reinforced 18 months later by the circumstances of the next USAF combat operation, the attack on Libya.

December 1985: Libya—Operation El Dorado Canyon

Following years of increasing tension, Palestinian gunmen attacked airports in Vienna and Rome on 17 December 1985, an act praised by the Libyan leader, Col. Muammar al-Qaddafi, who declared that he "had the right to export terrorism to America" (Anonymous, 1987). On 24 March 1986, Libyan armed forces fired several surface-to-air missiles at U.S. naval aircraft flying over the Gulf of Sidra. On April 5, 1986, a bomb exploded in La Belle Disco in Berlin, a nightclub frequented by United States service personnel. Of the 230 injured, 50 were American soldiers. The explosion killed one Army sergeant and one civilian, and a second soldier later died of his wounds. North Atlantic Treaty Organization (NATO) and U.S. intelligence sources implicated Libyan terrorists in this attack (Parker & Laturmy, 1987; Venkus, 1992, p. 67).

U.S. outrage following the Berlin terrorist attack led to considerable public discussion of military retaliation. Major Klaus O. Schafer, then Chief of Aeromedical Services at the USAF Hospital at RAF Lakenheath, United Kingdom (UK), was in Paris with his wife at the time and heard a radio commentator speaking of possible B-52 raids on Libya. Cutting his leave short, he returned to the base the next day. He contacted the Command Post and learned that the 48th Tactical Fighter Wing (TFW) at Lakenheath had received top-secret orders to prepare an operational plan for a strike on Libya (Klaus O. Schafer, M.D., M.P.H., Brig Gen USAF MC [Ret]. personal communication to DRJ, 19 Jan 2002).[84] An EF-111A squadron from the 20th Tactical Reconnaissance Wing (TRW) at RAF Upper Heyford, U.K. would provide the electronics countermeasures for the mission.

[84] Schafer, who retired in the rank of Brigadier General in 200, had been assigned to Lakenheath upon completing the Residency in Aerospace Medicine the previous summer. He recalls his role in this operation as the highlight of his career as a flight surgeon, the moment for which he had been training. He graciously consented to a telephone interview by DRJ about the aeromedical aspects of Operation El Dorado Canyon.

Admiral William J. Crowe, Jr., Chairman of the U.S. Joint Chiefs of Staff, had firmly delegated command and control of this joint U.S. Navy / USAF mission to the tasked units, bypassing the usual USAFE chain of command. "Up-channel reporting was minimized," and planning details were largely delegated to the unit level (Anno & Einspahr, 1988, p. 52ff). Crowe described his policy of non-interference from higher headquarters in clear terms: "You just clench your teeth and stay the hell out of it" ("Reagan's raiders: a new kind of war," 1986).

Even though the 3rd AF headquarters was co-located with its subordinate 48th TFW at Lakenheath, the 3rd AF commander received little information about the tasking orders sent to the 48th from Washington. In his book about the Libya raid, Col. Robert E. Venkus, then vice commander of the 48th TFW, emphasized the difficulties encountered because of ambiguous interpretations of the policy of systematically excluding intermediate headquarters from detailed orders sent directly to the bases (Venkus, 1992).

This policy, with its attendant security measures, prevented the unit flight surgeons from obtaining any aeromedical guidance. Schafer could not inform his hospital commander, who also served as 3rd AF surgeon, or the USAFE surgeon about the planned mission (K. O. Schafer, personal communication, 2002). Lt. Col. Peter K. Senechal, the flight surgeon at RAF Upper Heyford, also was unable to discuss the imminent mission with his hospital commander, and had to plan his aeromedical support for this highly unusual air combat plan strictly on his own (Senechal, 1988).

The first attack plan called for a strike route directly from England across France and the Mediterranean to Libya, but a few days later the wing received notification that France and Spain had refused permission for the overflight. Instead, the aircraft would have to fly an over-water route south from England over the Atlantic Ocean and then eastward over the Straits of Gibraltar and the Mediterranean Sea in order to reach Libya. This 13-hour mission would involve a grueling round-trip flight of 6,400 miles from England to Libya and back by the F-111F fighter-bombers and EF-111A electronics counter-measures aircraft. They would receive 8 to12 in-flight refuelings from 28 KC-10 and KC-135 tankers. Inasmuch as a standard NATO F-111 sortie was about two hours, the El Dorado Canyon mission placed an unaccustomed strain on crews and the complex avionic systems at the heart of the aircraft (Boyne, 1999; K. O. Schafer, personal communication, 2002).

In preparation for this mission, some of the aircrew members had recently participated in a "trial run" mission from the UK to Nova Scotia and back. However, Senechal, who flew the mission in one of the KC-10 tankers, remembers it as being a daylight run without any of the stressors of sleep deprivation and combat as factors. Although the mission was approximately the same length and culminated in bombing at a range in Nova Scotia, he does not remember any "go" or "no-go" medication being prescribed or used (Peter K. Senechal, MD, Col., USAF, MC [Ret.], personal communication to DRJ, 15 Jan 2003).

To illustrate the extent of this mission, Venkus wrote the following comparison:

> Imagine that you are on a round-trip drive from your home to a destination six hours distant...Your car is a small sports model; something like a Porsche or Corvette. You must wear a tight-fitting jump suit and a three-pound

helmet...fuel is pumped by hose from an accompanying fuel truck...there is no stopping—refueling must be done on the go at normal cruise speeds (excellent 'formation driving' skills are required; tailgating for several hours is a necessity). After six hours and nearing your destination, you must leave your friendly tanker and accelerate to near-maximum speed for a brief period during which the residents of your destination attempt to destroy you and your vehicle...[then] you must find your fuel truck in the dark again, and retrace the entire six-hour journey...the entire trip is done with the top up and the windows closed...and without access to any roadside facilities...you may carry one or two 'piddle packs,' plastic containers that are difficult to use when standing and nearly impossible to use accurately when sitting down...All of this may still be difficult to imagine...from hunger to thirst, to bladder distress, to imminent claustrophobia..." (Venkus, 1992, pp 110-11).

On the evening of 13 Apr 1986, the 20th TRW and the 48th TFW received notification from USAF Headquarters to execute the planned night air strike against Libya (Operation El Dorado Canyon). The mission schedule required the fliers to sleep during the morning of 14 April, brief that afternoon, and take off at 1800 for a time on target at midnight GMT. The six-hour return flight to England, with its predicable post-strike let-down of excitement, would include the early morning hours that represented the lowest point of the fliers' circadian rhythms. They would be landing about 0700 on 15 April.

These orders arrived directly from HQ, USAF, and re-emphasized the need for absolute security, even within Air Force channels, until the mission was completed. Schafer at Lakenheath and Senechal at Upper Heyford independently considered the possible use of sedative ("no-go pills") and stimulant ("go pills") medications. These were slang terms used by aircrew for secobarbital and dextroamphetamine, the standard medications used for fatigue management (then termed "crew conditioning") since the mid-1950s by the USAF (Smith BS, 1954; experience of DRJ). This was no routine decision for either flight surgeon. The USAF had previously authorized the use of "no-go and go pills" under similar circumstances, but had changed this policy in 1984 and no longer allowed aircrew to use them. Inexperienced in the use of the now-forbidden medications, yet also prohibited from consulting their professional superiors about the situation, both Schafer and Senechal decided in separate discussions with their operational commanders that safety of flight considerations should override the new policy.

In place of secobarbital (Seconal®), the traditional barbiturate used for crew conditioning by the USAF for several decades, Schafer would have preferred to use a newer benzodiazepine, temazepam (Restoril®). British flight surgeons had reported that their aircrew had used this medication with good effects in preparing for long flights during the 1982 Falkland Islands campaign (Baird et al., 1983; Fisher, 1983). However, the Lakenheath hospital pharmacy did not carry this medication, and Schafer considered that buying the medication on the British economy might constitute a breach of security (Schafer, personal communication, 2002). Instead, he chose to offer his fliers triazolam (Halcion®), a benzodiazepine with sedative effects even shorter than those of temazepam. Schafer was not aware at that time of reports about occasional idiosyncratic antegrade amnesia in some individuals taking triazolam, an effect not found with temazepam (PDR, 2002, p. 2823). Fortunately, none of the U.S. aircrew involved in the operation who chose to take this medication experienced this reaction. Schafer also issued two 5 mg tablets of dextroamphetamine to each flier for use if they became concerned about fatigue during the flight home (K. O. Schafer, personal communication, 2002).

Rapidly reviewing the little information available to him, Senechal decided to issue each Upper Heyford flier 100 mg of secobarbital as a sedative medication. He also issued 5 mg tablets of dextroamphetamine for use during the return leg of the projected 13-hour mission in order to assure alertness at the time of landing the following morning (Senechal, 1988).

> Air Force crews are tested for their tolerance and reactions to both "stop" and "go" medications so that the individual can make a decision on when to use sleeping pills or amphetamines to prepare for and fly especially long sorties. Accordingly, all El Dorado Canyon F-111 crews were offered these drugs for their use. Some declined to take the pills from the flight surgeon—[the fliers'] experience with negative reactions dictated against their use. Others accepted, but with no certainty as to whether or not they would actually use them. As expected on this longest of all fighter combat missions, many eventually chose to take the "go" pills to help them stay alert. And several had taken sleeping pills to ensure some rest during the chaotic last twenty-four hours prior to takeoff...[The crews spent Sunday evening preparing for the flight.] Once sufficiently exhausted, the crews slept. Rooms on base were made available...but few, if any, chose that option. Most of the 48th's pilots and WSOs slept in their own beds that night, trying not to betray their excitement and apprehension. Despite the chemical assistance, a number of them would get little quality sleep that Sunday night—their minds were too full with the myriad details they had to know to survive the next night. (Venkus, 1992, pp. 23, 99)

Senechal attended the aircrew briefings at Upper Heyford, but had time only to dispense the medications and describe their use. He had no time to discuss preflight diet, stress factors, sleep hygiene and management of bodily functions during flight. He wrote later that the general mood was professional and "no-nonsense," but that stress levels were high. Most aircrew had believed that they would be able to sleep well, and so few took the sedative medication. In fact, their tension led many of them to sleep poorly (Senechal, 1988).

Aeromedical concerns about fatigue appear not to have extended to aircrew flying the refueling tankers tasked for the mission. Venkus does not mention aeromedical support to the tankers, but the security restrictions imposed upon Schafer and Senechal in England make it unlikely that flight surgeons at the CONUS bases were aware of the schedules of their crews, since the CONUS-based active duty and Air Force Reserve tanker aircrew themselves had no information about the mission they were to support. Some of the tanker crews did not receive alert notifications until the afternoon of 12 April, about 24 hours before the attacking aircraft were due to become airborne in England. The takeoff times of the tankers from CONUS required them to fly non-stop to the United Kingdom, arriving less than 30 minutes before the first fighters were scheduled to take off. About four hours later, they received their first briefing about the raid on Libya. Then, having had only a brief rest, they began their final briefings for their own takeoffs. The combination of circadian disruption, sleep loss and hours in the cockpit experienced by these tanker crews made their fatigue a certainty. Fatigue may have contributed to some of the refueling rendezvous difficulties that occurred during the mission, which may then have adversely affected the performance of the attack aircraft (Venkus, 1993, pp. xiii and 176ff [footnote 1]).

U.S. authorities considered the raid a success, although only four of the 20 F-111Fs put their ordnance squarely on their targets. One F-111F was shot down, killing the pilot and the weapons systems operator. About half of the F-111F fliers and all of the EF-111A aircrew took dextroamphetamine after completing their combat assignments and turning toward their home base (Anonymous, 1987; Senechal 1988; K. O. Schafer, personal communication, 2002; Venkus, 1992, p. 23). The fliers reported feeling the stress and fatigue after the attack

rather than before it, and felt the medication benefited them. No fliers reported making mistakes or falling asleep during the return to base, and all landed without incident. Mindful of possible post-flight misuse, Schafer collected all unused dextroamphetamine tablets from his aircrew members during their post-flight briefings (K. O. Schafer, personal communication, 2002).[85] No crewmembers reported problems due to pre-flight meals, but some complained of non-specific "upset stomachs" (Senechal, 1988).

Most of the fliers who attacked Libya lived with their families on the bases of Lakenheath or Upper Heyford, or in villages nearby. Security regulations prevented any discussion of the operation with their families until it was completed, although Schafer expressed the opinion that many of his fliers, particularly those with "solid marriages," had privately discussed the upcoming mission with their wives (K. O. Schafer, personal communication, 2002). Both the fliers and their spouses later reported this enforced secrecy to be a major source of stress before and after the mission:

An F-111F squadron commander, unnamed at his own request, later stated:

> I'd had a tour and a half in Southeast Asia, but I had forgotten what seeing combat casualties was like. When you went into a combat zone like Vietnam, you knew months ahead of time and you had a chance to think about it, had a chance to say goodbye to friends and family. It was a lot different, a lot tougher, in a noncombat environment like Lakenheath. On Sunday evening everything was fine, and you were with your family. But on Monday, you had to report for work at 2 in the afternoon knowing that you were going to launch a combat mission. It was very difficult to deal with. As a squadron commander, I was very close to the families and I had to pick the crews (Anonymous, 1987).

Families generally handled this stressor well, though there was some resentment among both fliers and wives over not being able to discuss what was about to happen. "Too much had gone into years of marriage for the couple to be dishonest with each other in the last few hours before the mission in which the aircrew member might possibly be killed" (Senechal, 1988).[86]

Radio and television stations broadcast news reports of the attack, as well as rumors concerning the loss of one or several aircraft, while the F-111s were enroute home. Venkus wrote forcefully about the effects of these news releases:

> Before 2 A.M., I gave the orders that would recall the people we had put on alert earlier—doctors, chaplains and others—for a brief meeting that would determine how and when we could notify the affected families. ...[As the aircraft returned,] telephone conversations were undoubtedly in progress between concerned friends and relatives and their loved ones in East Anglia. There was a definite chance

[85] About a year after the raid, a staff member of the USAF Surgeon General's Office contacted Schafer about his issuing dextroamphetamine tablets to his fliers. A member of Congress was concerned that the pilot or the weapon systems operator who had been shot down might have taken the medications before the strike. Based on his pre- and post-flight briefings and discussions with his crews, Schafer assured the staff member that none of the aircrew members had even considered taking a tablet until well established on the long flight home, and then used the medications only to stay alert for refuelings and landings (K.O. Schafer, personal communication, 2002).

[86] Senechal was particularly attuned to such factors. Along with aviation psychologist Anthony C. Traweek, Ph.D., he had instituted an aviation psychology program at RAF Upper Heyford in 1985 (Senechal & Traweek, 1988).

> that the families of our missing crew would find out about the loss of our jet in that manner, rather than through our official notification... By 5 A.M., BBC radio had also begun reporting that five aircraft had been lost on the raid—the wives who knew the raid was in progress fought back panic as they heard this exaggerated bulletin. By 6 A.M., squadron commanders' wives were making and receiving calls, trying to relieve the fears and passing on rumors they had heard from unknown sources that only one airplane was down (Venkus, 1992, pp. 117-119).

The post-raid tensions were just beginning:

> The base's new status as the world's premier target for terrorist reprisals was already having an effect: guards with M-16 rifles checked every ID card at the main gate. ...The 48th TFW had conducted warfare against terrorists; it was not unreasonable to believe that terrorists would respond...they could very well decide to hit those who had done the bombing. ...The 48th Wing's part in El Dorado Canyon was...significant [in] the fact that it was launched from a "peacetime base" in peacetime. By a peacetime base, I mean one that, while equipped at all times to fly and fight, has not been able to take prudent actions in preparation for combat. Such actions would include evacuation of civilian dependents as hostilities approached... (Venkus, 1992, pp. 119-120).

The families living in small villages around the base had no recourse to on-base security, and British civilians living in the area also felt threatened. Schafer recalled the British newspaper, television and radio coverage—essentially the only press sources available to USAF families overseas—as being universally negative and condemnatory. He became aware of the demoralizing effects of these public criticisms; one wife accused her husband of being a "baby-killer." Schafer spoke with the 48th TFW commander, Col. Sam W. Westbrook III, about the situation, stating that morale was suffering and offering to speak to the press. The commander advised Schafer not to do so, since that was properly a Public Affairs Officer function. Instead, Westbrook arranged a satellite downlink of American television coverage into the base at Lakenheath, allowing the USAF troops and their families to witness the positive reaction in their own country. Schafer noticed an immediate and positive effect on the morale of the wing (K.O. Schafer, personal communication, 2002).

As the British press debated and condemned the attack, local support for the Americans rallied, and the local Member of Parliament chastised those who were spreading fear and hysteria. In time, the neighbors of the fliers came to accept the threat of terrorist retaliation "with traditional British resolve." Still, the possibility of terrorist retaliation affected aircrew attitudes so deeply that, when Venkus researched the raid over four years later for his book, some of the fliers who had participated in the raid refused to allow their names to be used, or even refused to be interviewed anonymously by their former wing vice commander (Venkus, 1992, pp. 124-125).

The lessons learned during the raid on Libya repeated some of the experiences of a few U.S. fliers in Korea and Vietnam who flew combat missions from bases where they lived with their wives and children. These circumstances have continued in later actions in Southwest Asia, the Balkans and Afghanistan, and may represent a pattern in combat operations yet to come. Future operations of this nature will inevitably raise similar morale issues in operational fliers, flight surgeons and their families. In the Conclusions section of this report, the authors will examine some of the implications of such circumstances for flight surgeon care provided to fliers and their families.

Senechal's article about his experiences in support of this mission ended with some specific recommendations:

1. Although dextroamphetamine worked well as a stimulant medication, secobarbital was unsuccessful as a sedative because aircrew had no confidence in it and did not use it. He recommended that a short-acting medication such as temazepam be adopted for this purpose and be ground-tested by fliers on a non-flying day in order to acquaint them with its action. Flight surgeons should emphasize to aircrew the prophylactic use of sedative medication even if the fliers believe they will able to sleep without it. Pre-raid restlessness and insomnia occurred before the mission to Libya. The EF-111A crews "felt that they were tired enough from not having slept in the previous 24 hours so that they would be able to sleep during the day prior to the mission...they underestimated the fact that they were so nervous that they would not be able to sleep." Also, some "just did not trust medication prior to flying, especially prior to such a crucial mission."
2. Fliers need to eat a proper diet on the day before long flights, avoiding high-bulk foods and emphasizing complex carbohydrates. They should drink adequate fluids during the flight.
3. Commanders and flight surgeons of squadrons that may be suddenly tasked with combat missions should discuss this fact with fliers and their families in general terms when the flier joins the squadron. This would give them some time to prepare for such possibilities, and might help reduce family stress.
4. The unusual degree of security and secrecy imposed upon this mission precluded adequate flight surgeon briefings to the fliers. If possible, flight surgeon briefings concerning combat missions should begin several days before the first mission in order to cover necessary topics, including preparatory briefings on the nature and manifestations of combat stress before the combat begins. This is more useful than a last-minute briefing in the middle of the night.
5. The high degree of stress felt during combat operations is unanticipated by many fliers, and may be uncomfortable to experience. Prior briefings on such stress reactions may be beneficial (Senechal, 1988).

To these lessons, we would add the observation that tactical units may receive combat orders with little notice. *Flight surgeons assigned to such units should assure that crewmembers routinely receive periodic refresher lectures on aeromedical subjects pertinent to combat missions.* This will preclude the need for hurried instruction in complex matters such as crew rest, the use of sedative and stimulant medications, and proper nutritional preparation for long missions during the rushed and stressful times of actual tasking.

December 1989: Panama—Operation Just Cause

On 4 February 1988, U.S. grand juries in Tampa and Miami indicted Panamanian President Manuel Noriega *in absentia* on thirteen counts of drug trafficking and racketeering (Anderson, p. 167). He responded with increasing harassment of U.S. citizens by his paramilitary forces. Following months of political sparring and an unsuccessful coup attempt in October 1989, Noriega increased his anti-American rhetoric to new levels. On 15

December, his "handpicked national assembly had rubberstamped the order proclaiming him 'Maximum Leader,' a position of unlimited extra-constitutional power. And they had endorsed a proclamation that "a state of war existed between Panama and the United States" (McConnell, 1991, pp. 18-19). These actions were followed by isolated attacks by Panamanian militia upon US servicemen and dependents, including one that killed a U.S. navy lieutenant.

U.S. forces had developed a plan to overthrow and capture Noriega during late 1989. This plan reflected the need for rapid and decisive military action to separate the dictator from his armed forces and militia units in order to avoid the prolonged guerrilla warfare that would occur if he were able to escape into the jungle-covered mountains outside Panama City. On 17 December 1989, President George H.W. Bush ordered this plan into action within two days (McConnell, 1991, pp. 17-21).

At dusk on 19 December, two F-117A Nighthawks of the 37th TFW departed their home base at the Tonopah Test Range near Nellis AFB, Nevada. Their mission, the first stealth fighter combat action in history, was to provide initial air support for an aerial assault force of 144 C-141s and C-130s. The fighters refueled six times from a KC-10 tanker en route to their targets. Air National Guard A-7s from Ohio and South Dakota and A-37s from Howard AFB in Panama provided fighter escort to the transports and their supporting refueling tankers as they flew south. A string of search and rescue aircraft covered the 2000 miles between the southeastern U.S. and Panama. Special Operations AC-130 gunships from Florida deployed to cover the attack. Since all the U.S. aircraft except those based at Howard staged out of CONUS bases, the USAF did not have to perform a full deployment of forces to forward operating bases (McConnell, 1991, pp. 38-40, 58-59, 79-84). As with the assault on Grenada, flight surgeon support of this operation came from the home bases in the U.S., and little if any record remains in the aeromedical literature concerning their work at those bases.

Military and civilian casualties soon saturated Gorgas Army Hospital at Panama City, the major military medical facility in Panama, and the smaller Howard Air Base hospital. Some 253 U.S. casualties were evacuated to Army and Air Force hospitals in San Antonio, Texas, presenting these essentially peacetime facilities with acutely wounded patients during the Christmas holidays (US Med, 1990, pp. 1-7, 6). Active aeromedical evacuation support came from the 32nd and 34th Aeromedical Evacuation Flights (AEF), the latter deploying 11 flight nurses and 16 medical technicians from Kelly AFB, Texas. The After-Action Report of the 34th AEF notes that much of their work in receiving casualties and readying them for evacuation was carried out at night, and the difficulties encountered led to specific recommendations for peacetime training in night evacuation procedures under combat conditions (Johnson, 1990). This report makes no mention of flight surgeon screening of the casualties.

The U.S. forces accomplished all their major military objectives within one day. By 24 December, Noriega's forces had surrendered and he and his two remaining bodyguards were fugitives in hiding. Noriega sought refuge in the Vatican Embassy, where he remained until diplomatic negotiations led to his surrender on 3 January 1990.

Lt. Gen. Monte Miller, USAF Surgeon General, later commented that the lessons learned in the 1983 invasion of Grenada about the need for interservice medical communication and cooperation had been applied to later readiness training. As a result, he felt that USAF medical coverage in Panama had gone more smoothly than in Operation Urgent Fury, the 1983 Grenada invasion in the same theater (US Med, 1990, pp. 1,7). The cumulative value of these combat experiences, lessons learned and subsequent training would soon be tested on a major scale.

January 1991: The Persian Gulf War—Operations Desert Shield and Desert Storm

Iraqi forces invaded and occupied Kuwait on 2 August 1990. In response, many nations denounced the Iraqi aggression and began to send troops to the Middle East. President George H.W. Bush announced that the U.S. would provide military support to the Kuwait regime and began to deploy forces in strength within a week.

The policies of the USAF Medical Service concerning training for operational and deployment medicine had been honed by a decade of humanitarian missions and rapid response actions.[87] These policies proved their worth in the Persian Gulf War. For the first time in its history, the Air Force entered a major conflict with most of its medical officers and particularly its flight surgeons already trained and experienced. In the words of Air Force Medical Service Historian James S. Nanney, Ph.D.:

> The Persian Gulf War, which lasted from August 1990 through February 1991, required the deployment of thousands of Air Force Medical Service members, either to Europe or to Southwest Asia. In hindsight, the war was a checkpoint in a two-decade process of Medical Service readiness reengineering that began in 1979...War seldom ceases to surprise its practitioners. In the Gulf War of 1990-1991, the Air Force Medical Service tested its concepts of emergency response created in the 1980s. The Medical Service found that those concepts were still valuable but needed significant modifications in a new theater. (Nanney, 2001)

Some deploying flight surgeons found themselves excluded from deployment planning sessions due to inadequate security clearances or from unfavorable assessments of their "need to know." Later reviews noted that such exclusions degraded the ability of flight surgeons to make pertinent determinations about their mobility requirements, or to make informed decisions or contributions during the deployment process. *This omission represents an example of a lesson learned in Vietnam that had been forgotten by those planning the deployment to Southwest Asia (SWA).* In contrast, several well-informed flight surgeons chose not only to brief their flying squadrons on the medical aspects of the planned operation, but also to brief deploying maintenance and support squadrons. They felt that this process paid great dividends in decreased morbidity among these vital personnel after arrival in SWA (U.S. Secretary of the Air Force, 1992, p. 6).

Initial deployment of U.S. forces took place under the code-name of Operation Desert Shield. USAF medical personnel were among the first to arrive in SWA, and for the first six weeks provided the only substantial U.S. medical presence there. Col. Leonard M. Randolph, Jr., MC, deputy Tactical Air Command (TAC) surgeon, led the advance Air

[87] For a chronological listing of USAF humanitarian missions and responses, see Haulinan, 1997.

Force Medical Service team. In early August 1990, he and eight other USAF medical personnel departed with the first Air Force fighter units for Riyadh, Saudi Arabia. There, in coordination with Col. Robert P. Belihar, USAF MC, a RAM graduate serving as the surgeon of the U.S. Central Command (CENTCOM), Randolph established the office of the Forward Surgeon for the Air Force component (CENTAF) of CENTCOM that supervised air operations in SWA, including the Persian Gulf and the Arabian Peninsula. Riyadh was within a 12-hour drive of 3000 or more Iraqi tanks, located on the border. Randolph later stated, "It was hard for airlift to be obtained.... I remember that it took perhaps 30 to 45 days before we really started seeing significant Army medical components." Within those 45 days, the Air Force deployed and employed 15 Air Transportable Hospitals (ATHs) and one 250-bed contingency hospital. Each 50-bed ATH was designed for transport, along with its 128 personnel and their baggage, on six C-141 transports. An ATH was designed to be erected in about two days, and then could function for about a month without resupply, furnishing basic medical and surgical support to a 72-plane Tactical Fighter Wing and about 4000 people (Nanney, 1992). These hospitals soon became busy seeing patients, "almost all of them Army patients" (Cohen, 1993, p. 205; Nanney, 1992).

The deploying USAF flying squadrons included their Squadron Medical Elements (SMEs) as integral personnel. Most SMEs consisted of a flight surgeon and two aeromedical technicians working in an Air Transportable Clinic (ATC) that contained first aid and emergency medical supplies, but no in-patient beds (Cohen, 1993, p. 201). The first SME left the US on 8 August 1990, just one day after the first fighter squadrons departed. Most arrived and were in operation within a day of aircrew arrival (Nanney, 1992). Some flight surgeons deployed in unit aircraft, some via MAC airlift, and some on commercial charter flights. SMEs formed the backbone of USAF deployment medical support; during the first month of Operation Desert Shield, 13 of the 17 "bed-down" sites had only the SMEs for on-base medical services. Even so, at ten sites, the ATC equipment arrived four days after the flight surgeon and the technicians, and at some sites, the clinic equipment never arrived at all (U.S. Secretary of the Air Force, 1992, p. 7). These logistics problems were due to deployment priorities established by CENTCOM, rather than to a shortage of deployable clinics or hospitals. Air transport priorities sometimes precluded the clinics from arriving concurrently with the units they were to support, or else forced a downsizing of the medical pallets (Cohen, 1993, p. 207). In cases of delayed SME arrival, flight surgeons used their own "flyaway" kits (U.S. Secretary of the Air Force, 1992, p. 7).

Adding to the difficulties, several flying units had received information that they would not need their ATCs at their forward bases, and thus did not deploy them. "This was universally bad advice" (U.S. Secretary of the Air Force, 1992, p. 6). In fact, the ATCs proved so useful that those located at Cairo West (military population, 800) and at a few other locations not large enough to warrant ATHs were converted into "Class B Dispensaries," a Vietnam-era term resurrected by medical planners. This was accomplished by the addition of 8-10 holding beds, an extra physician or two, and a few technicians and support staff in order to diminish the need to transfer patients into ATHs or Army medical facilities merely for bed rest. Generally, though, "having a hospital [i.e., an ATH] establishes a certain mindset, not only for the deploying wing—they feel more secure having that hospital—but also for the families at home" (Nanney, 1991, pp. 15-16). *Being able to demonstrate to*

military personnel and their family members that deployed troops have adequate medical care easily available is a morale factor of inestimable value.

As the deployment progressed, CENTAF augmented each SME with a bioenvironmental engineer (BEE) and technicians, sometimes accompanied by an independent duty medical technician or a general medical officer. The medical staff augmentation allowed flight surgeons to have some time off, while providing the base with 24-hour SME coverage. CENTAF also notified each SME of the location of the ATH that would provide its preventive medical consultation, hospitalization services, and medical resupply (Cohen, 1993, p. 208-9).

At the peak of the USAF buildup, 52 SMEs were in operation in SWA. They averaged about 2.3 patient visits per person deployed during the yearlong operation, which amounted to eight visits per thousand persons on base per day (8/1000/day). Where ATCs and ATHs were co-located, the ATCs (primarily manned by flight surgeons) saw about 14% of the outpatients (U.S. Secretary of the Air Force, 1992, Appendix A).

An emphasis on preventive medicine generally proved effective in keeping non-effectiveness rates low. "In spite of the conditions, strict water and sanitary discipline kept the disease and non-battle injury rates to one-half of the prewar predicted levels. This represented a major victory over the greatest casualty generator in military history" (Cohen, 1993, p. 206). The disease and non-battle injury rates per 1000 personnel were 17, rather than the 27 predicted. The predicted in-patient rate was 3/1000/day; the actual rate was 0.34/1000/day. However, 16 outbreaks of gastroenteritis occurred at ten locations, affecting 2700 personnel (Cohen, 1993, p. 213).

Among fliers, the most common causes for groundings were upper respiratory infections and gastroenteritis. Notably, *the Air Force did not cancel any planned flying operations due to medical reasons throughout Operations Desert Shield and Desert Storm* (Cohen, 1993, p. 230; Nanney 2000). *This is the ultimate measure of flight surgeon support to the operational flying units, and to USAF medical support in general.*

USAF policies regarding "go" and "no-go" medications had changed since the Libya raid. Belihar recalled that USAF regulations in effect during Desert Storm placed no restrictions on the use of these medications except for the professional requirement for prior ground testing of aircrew and medical monitoring at the time of the missions. He noted that some members of the press expressed considerable interest in the matter, sometimes from a sensational point of view ("Are our pilots taking 'speed' before they fly?"). His response to media inquiries was to cite the successful history of use of such medications for many years, giving examples from the past to defuse the potentially lurid aspects of the story (Robert P. Belihar, MD, MPH, Brig Gen USAF MC [Ret], personal communication to DRJ, 2002). Desert Shield/Desert Storm medical after-actions report notes a 65% use of 5 mg dextroamphetamine stimulant tablets by aircrew in single or double-place aircraft during these operations, characteristically about six hours into a mission, or during night flying (U.S. Secretary of the Air Force, 1992, p. 7). Of 464 TAC pilots responding to a survey, 57% used "go pills," and among those who used them, 61% considered them "essential" to

the conditions of combat operations they encountered (Cohen, 1993, pp. 229-30; U.S. Secretary of the Air Force, 1992, p. 13 and Appendix C). Aircrew reported no systematic problems; the medications were suspected in one case of nausea, two cases of "jitters," and possibly in one episode of spatial disorientation. Of 269 fliers responding to a survey concerning the use of 30 mg temazepam sedative tablets by aircrew, 54% said they had used them, usually either because of the ambient noise in their quarters or in order to "unwind" and get to sleep. These aircrew reported no ill effects from the medication (U.S. Secretary of the Air Force, 1992, Appendix C).

Active combat operations, code-named Operation Desert Storm, began on 16 January 1991 with the departure of a B-52G from Barksdale AFB, Louisiana for the longest USAF bombing mission to that point in history, a 35-hour round trip. The air campaign strikes began at 0238, 17 January with an attack on Iraqi early-warning radar stations by MH-58 Pave Low special operations helicopters and F-117A Stealth fighter-bombers. Among those killed in the initial actions was a USAF pilot/flight surgeon, Major Thomas F. Koritz, whose F-15E was brought down by Iraqi ground fire on the second day of the war. Koritz was the first USAF flight surgeon to die in combat since the Vietnam War, and the thirteenth in history.[88]

At the end of combat operations on 28 February 1991, USAF aircraft had flown some 67,151 sorties. Combat air patrols might last 6-8 hours, and could be coupled with an alert duty tour of equal length during a single day. Crew rest periods of only six hours were not uncommon, and quality and depth of sleep were diminished by noise, heat and dust. Tanker crews flew schedules that alternated 12 hours of flying duties, 12 hours of rest and 12 hours of alert, leading at times to 36-hour crew duty days. Flight surgeons later reported fatigue to be the most pervasive and significant aeromedical problem they encountered, possibly contributing to two non-fatal combat mishaps. Squadrons that were designated exclusively for day flying or for night flying found that they quickly adapted to the single, consistent schedule allowed by this policy. These squadrons encountered fewer problems than those that flew alternate day and night mission schedules. Some flight surgeons considered their unit commanders to have a poor understanding of the effects (combined and cumulative) of chronic stress and fatigue (U.S. Secretary of the Air Force, 1992, p. 12).

Other problems also arose. Uncertainty about the length of the deployment became a significant stressor, not only for those deployed to SWA and to Europe, but also to their families. After one individual was sent home when his wife suffered an emotional breakdown, some flight surgeons felt that other troops had understood a "message" that aberrant or suicidal behavior on the part of a spouse could get the deployed member out of the combat theater. In response, home bases developed support groups and other mental health capabilities, and the trend subsided (U.S. Secretary of the Air Force, 1992, p. 14). This matter, briefly mentioned in the cited report, exactly parallels the experience of DRJ during the Vietnam War, both during his tour at Myrtle Beach AFB, SC in 1964-6, and later in SEA. *"Acting out" behavior of families at home may be expected in any combat*

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[88] Information obtained from a plaque at the USAFSAM Classroom Building, Brooks City-Base, Texas. A second plaque there commemorates the 92 flight surgeons killed in aircraft mishaps from 1918 to 1992. See Appendices A and B for complete listings of these data.

deployment. Such behavior should be countered with strong USAF family support programs, but should not result in deployed individuals being sent home.

Another problem was the matter of investigating non-combat aircraft mishaps, which required full board action and reports. Such duties, by regulation, require the participating flight surgeon to give primary attention to the mishap investigation, a process that may take as long as a month. Identifying and handling human remains is not a primary medical responsibility, and unit-assigned flight surgeons found that becoming involved in a formal accident investigation greatly detracted from their abilities to support their operational aircrew. In the after-action medical report, all concerned agreed that, once the acute response phase of a mishap had passed, a flight surgeon from a rear-echelon unit should serve as permanent board member, allowing the deployed flight surgeon to return to his or her primary support of the fighting unit (U.S. Secretary of the Air Force, 1992, p. 26).

Although flight surgeons were not prohibited from participating in combat operations in their usual role as aeromedical observers, many (especially in fighter and attack squadrons with limited or no second seats available) found it difficult to get flying time with unit aircraft, and had to log time in transports or helicopters (U.S. Secretary of the Air Force, 1992, p. 7). The CENTCOM surgeon, Col. Robert P. Belihar, flew as an aeromedical observer on 77 combat support sorties during Desert Storm and "felt that even that limited participation enabled me to better serve the interest of deployed personnel and the theater medical system that supported them" (Robert P. Belihar, MD, MPH, Brig Gen USAF MC [Ret.], personal communication to DRJ, 2000).[89]

As the campaign continued, supply logistics could not keep up with medical requirements. Medical personnel used "bargaining, borrowing, trading, confiscating, stealing, and local purchasing" to fill their needs until a steady supply system could be established (U.S. Secretary of the Air Force , 1992, p. 9). Flight surgeons considered local purchasing to be the most useful of these options, an opinion echoed by Lt. Col. Robert A. Ferguson, the CENTAF forward director of medical plans (Nanney, 1991).

A total of 14 USAF aircraft and 20 crewmembers were lost to enemy action during Desert Storm, including an AC-130 gunship with 14 aircrew brought down by a shoulder-mounted surface-to-air missile (www.vfw.org/magazine/sep97/18.shtml). Although the current report does not address the contributions of U.S. Army flight surgeons in the modern era, mention must be made of Major Rhonda Cornum, MC USA, an Army flight surgeon with the 2-229th Attack Helicopter Battalion, attached to the 101st Airborne Division (Air Assault). Cornum volunteered to participate in the attempted rescue of a USAF F-16 pilot shot down on the fourth day of the war. The same Iraqi defenses that had downed the jet shot down the lightly-armed UH-60 Blackhawk helicopter in which she was flying, killing four crewmembers. Iraqi soldiers captured Cornum and two other crewmembers. She suffered multiple injuries including a bullet wound to her right shoulder, two fractured arms, one fractured finger and the internal derangement of one knee. Held for a week in an Iraqi

[89] Belihar served as CENTCOM surgeon during the Gulf War, a position in which he reported directly to Gen. Norman Schwarzkopf. He later retired with the rank of Brigadier General. Gen. Belihar kindly consented to a telephone interview by DRJ in 2000 about the medical aspects of Operation Desert Storm.

prison, she returned to the U.S. forces after the end of the war (Cornum, 1992). Her mission, captivity and return with honor exemplify the finest traditions of military aviation medicine.

Aeromedical evacuation contingencies played a large role in the deployment of USAF medical resources to Southwest Asia. Previously, the flight surgeon role in air evac operations had mainly involved pre-flight screening of patients in hospitals or casualty staging units. However, during the Gulf War, as in Grenada, the Air Force used some flight surgeons in the air evac system itself. Because of the possibility that U.S forces would sustain too many casualties to be treated in the combat theater, air evac supervisors prepared for long-range evacuation flights carrying non-stable patients requiring specialized medical monitoring. Initial plans for this contingency called for the assignment of flight surgeons to 12 strategic and 12 tactical air evac (C-130 aircraft) positions (Cohen, 1993, pp. 221-2).

Committing this number of flight surgeons to air evac support held the potential for straining flight surgeon support to operational units. Shortly before ground operations began in mid-February 1991, the CENTAF surgeon reminded commanders of base SMEs and ATHs that flight surgeon support to air evac operations remained secondary to their primary mission within their operational units. "Because of the primacy of aircrew medical support, squadron medical element physicians were prohibited from augmenting aeromedical evacuation crews. Nevertheless, twenty-two Air Force flight surgeons were assigned to aeromedical evacuation duty at six C-130 bed-down locations and five strategic locations. Partly because of this program, no deaths or morbidity were attributed to the aeromedical system" (Cohen, 1993, p. 222). The emphasis on air evac capabilities reflected the overall concern that Iraqi defenses would inflict many casualties once the ground war began, a concern that proved groundless (Nanney, 2000).

In reviewing the contributions of flight surgeons to the Gulf War, the authors of this report have not distinguished between the work done by those on active duty and those mobilized from the Air Force Reserve and the Air National Guard. However, full credit must be given to the Reserve and Guard flight surgeons, as well as all other medical personnel who deployed, with their units and as individual augmentees, both overseas and within the U.S. Much of the support to aircrew flying combat missions was given by flight surgeons at established USAF and NATO bases in Europe. A single table demonstrates the magnitude of this mobilization:

Table II. Gulf War Medical Manpower Summary

Location	Active Duty	Reserve Component	Total
Southwest Asia	2,342	2,526	4,868
Europe	3,874	3,019	6,893
CONUS	28,662	6,295	34,957

(Cohen, 1993, p. 206)

Medical and aeromedical support to the 55,000 USAF troops in the SWA theater was provided by the 4,868 medical personnel listed in Table I, about 9% of the total deployed force. An additional 6,893 medics served in Europe, many on deployment status. The Medical Service and its active duty, Reserve and Guard flight surgeons had supported all the deployed forces extremely well. Lt. Col. Robert A. Ferguson, USAF, MSC, the chief of plans and operations in the advance medical team, concluded:

> Our number one mission is to support the deployed wings.... Our job is not to support maneuvering Army units; it's not to support maneuvering Marine units; it's not to put ATHs on the front lines receiving those kind of casualties. Nevertheless, we were looking at every possible means that we could, to give the CINC [commander in chief, CENTCOM] more medical capability, over and above what the Air Force was expected to do... (Quoted in Nanney, 2001).

March 1999: The Air War Over Serbia—Operation Allied Force

Following months of internal military and political conflict in the area formerly known as Yugoslavia, Serbian troops began a series of massacres of Kosovo Albanians in October 1998. As the United Nations Security Council condemned the killings (United Nations Security Council Resolution 1199), the U.S. and Britain urged their citizens to leave the region (Clark, 1999). U.S. Secretary of Defense William Cohen warned Serbian President Slobodan Milosevic that air attacks might begin within two weeks unless the violence ceased. This led to some signs of the withdrawal of Serbian troops from Kosovo within a few days, but a week later Russia announced that it would veto any UN authorization of air strikes. U.S. President Bill Clinton responded that NATO was prepared to initiate the air strikes unilaterally if the UN was not able to carry them out, and authorized the deployment of additional U.S. airpower assets into the theater, such as F-15 units moving into the airbase at Cervia, on the east coast of Italy (Taylor & Casey, 2000). The U.S. envoy to the area, Richard Holbrooke, informed Milosevic of the actions he would have to take to avoid the air attacks, and on 16 October 1998 NATO gave an ultimatum that he must undertake those actions within four days, a period later extended to 14 days. As the Serbians slowly pulled back, the UN Security Council authorized deployment of ground and air monitors to insure the continued withdrawal of the Serbians. By 27 October 1998, the bulk of the Serbian forces had pulled out of Kosovo, and so NATO conditionally withdrew its threats of military action (Clark, 1999).

The1998 massacres led USAFE headquarters to begin planning for a Balkan air campaign (Turner & Casey, 2000, p. 1). The USAFE Surgeon was Brigadier General George Peach Taylor, Jr., USAF MC, a RAM. Taylor also served as surgeon to the Air Force Forward (AFFOR) and to the Joint Forces Air Component Command (JFACC). Under his supervision, USAFE medical authorities prepared to establish aeromedical support at any airbase location that might prove operationally necessary. Some of those locations were bare bases, defined in the Air Force's "Bare Base Conceptual Planning Guide" as "a site with a usable runway, taxiway, parking area and a source of water that can be made potable" (AFPAM 10-219, 1996), while other deployments were planned into more established facilities. In order to furnish medical support at all operating locations from the first day of operation, experience had shown that medical deployment resources would be competing for logistical support—especially airlift—with all other deploying assets.

General John P. Jumper was Commander, U.S. Air Forces in Europe, and, within NATO, the Commander, Allied Air Forces Central Europe, at Ramstein Air Base, Germany. Jumper and Taylor, his surgeon under both 'hats,' agreed that the medics would be guaranteed immediate deployment if Taylor would assure that the medical footprint—the manning, weight and cubage of the deployed medical assets—would be custom-fit to each location and would be held to the absolute minimum required for the mission. The underlying philosophy agreed upon by the two generals was to provide medical and aeromedical services quickly and efficiently and with minimum airlift requirements—in Taylor's words, "early, light, lean and lifesaving" (Taylor & Casey, 2000; see also Taylor's taped comments).[90]

Beginning in late 1998, on-the-spot site surveys of all proposed deployment bases provided the data needed to organize medical support and to inform incoming medical forces of their tasks (Taylor & Casey, 2000, p. 1). A Preventive Aerospace Medicine (PAM) team, usually consisting of an experienced flight surgeon or public health officer and a bioenvironmental engineer (BEE), accompanied teams of line officers to perform "snapshot, quick in-and-out" assessments of local capabilities and needs at each proposed deployment location, whether at a bare base, at an established NATO base, or at another facility. The PAM teams defined their mission as "mission force tailoring," a different approach than the buildup for Desert Shield/Desert Storm in 1990, which a team member recalled as having been, "Put it *all* in." The need for the fine-tuning of deployment assets during the rapidly changing conditions of the 78-day AWOS resulted in changing the basing plans for air combat operations units 70 times. The U.S. General Accounting Office later presented a detailed analysis of this complex planning and surveying process to the Chairman of the House Armed Services Committee in 2001 (U.S. Government Accounting Office, May 2001).

Air Force doctrine in 1996 called for medical support at established bases to be provided by in-place medical resources, augmented by deploying medical personnel and facilities if necessary. Deployment plans used the Squadron Medical Element (SME) as the basic building block. This Element had been designed to deploy as the integral medical support to a flying unit of squadron size or smaller. A SME consisted of a flight surgeon, two or three medical technicians, nesting boxes of basic medications and supplies, medical reference materials and diagnostic equipment. Planners acknowledged that airlift priorities would be a critical factor for the first few weeks of the campaign, and that deploying flight surgeons would probably have less than one full pallet-load of medical supplies available. The basic SME met these airlift requirements, and could later be augmented by an Air Transportable Clinic (ATC) and an ambulance if necessary (Taylor & Casey, pp. vi, 1). The ATC could be located in about 1500 square feet. If no permanent building could be adapted for this purpose, a deployable tent or prefabricated building would serve as the clinic. This unit required electric power for its heater, lights, refrigerator, portable sterilizer and other equipment, and might bring one field ambulance for its use (AFPAM, 1996, Chap. 11, p. 151).

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[90] Citations by Taylor, Robb, Brannon and Klein are based upon an audiotape of a panel presentation made at the 2002 Annual Meeting of the Aerospace Medical Association (AsMA), and on brief abstracts that were published before the meeting. Interested readers may order the tape, #61, entitled "USAF medical support for Kosovo & Serbia," from www.soundontape.com, or the vendor may be contacted through the AsMA.

USAFE planning considerations for SME deployment in 1998 included possible sites, local military and civilian medical capabilities and transport, local food and water sources, sanitation, waste disposal, endemic diseases, dust, pollen, and other matters of preventive medicine or public health concern, as well as potential terrorist threats. Turner noted that the PAM team members had to function as medical ambassadors in their interactions with local civilian, military and medical authorities. The time flow plan for progressive medical support at a specific base would have to parallel the buildup of forces there and be carefully tailored to the changing circumstances ("precision engagement"). Planners also acknowledged the potential for changes in such plans and stressed the importance of flexible responses to contingencies. They advised deploying flight surgeons to guard against lapses in resupply by allowing at least a four-day lead time "window of delay" in all requests (Chini & Turner, 2001; see also footnote 90 above).

In all, medical teams surveyed over 22 locations in 11 countries. Each PAM team used a form developed and refined by USAFE, augmented by face-to-face interviews with local medical officials and by photographs taken on the spot with the approval of those officials. PAM teams reported directly to the USAFE Surgeon's Office. The chief flight surgeon there, Lt. Col. Douglas J. Robb (a RAM), maintained individual contact with each deployment location as the operation progressed (Douglas J. Robb, Lt Col USAF MC, personal communication to DRJ, 4 June 2002). One PAM site surveyor, recalling the "Wild Weasel" SAM suppression missions flown by fighter-bomber pilots in previous wars, described his role as that of a "Medical Weasel" doing pre-emptive planning strikes against possible aeromedical contingencies on surveys in England, Germany, Italy, Poland, Hungary, the Czech Republic, Albania, and Turkey, among others.

Planners assumed that aeromedical evacuation would be available for urgent requests within 4-6 hours and routinely available every 72 hours. Adding this assumption to their assessment of locally available backup medical care, the teams calculated the minimal local medical footprint—the SME plus necessary augmentations—that would have to be deployed into each location (Taylor & Casey, 2000, p. v). "This honest assessment of medical requirements in turn gained credibility with airlift allocation and allowed for the proper medical assets to be 'on board' early in the phased deployment" (Chini & Turner, 2001; see also footnote 90).

This careful medical planning, carried out in close coordination with line authorities and based on a clear understanding between the Air Force commander and his surgeon, represents the fruits of lessons learned in previous conflicts and, for the first time, not forgotten between wars. Among the top contributors to troop morale is the visible presence of quick and adequate medical care from the first day of deployment to the last day of redeployment. This care must be accompanied by the sure knowledge that backup care is easily and dependably available, either from local resources or from aeromedical evacuation. The U.S. Air Force Medical Service, backed by the line commanders, used flight surgeons as their primary medical resources and provided these services to its troops throughout the Serbian air campaign.

The cycle of Serbian-Kosovar attack and retribution intensified during January 1999. Milosevic increased his defiance of attempts by the international community to mediate

between the opposing forces, and evidence mounted that he was overseeing a deliberate policy of genocide. Each week, the escalating tensions between Serbian military and paramilitary forces and international organizations—the UN and NATO in particular—made the possibility of outside military intervention more likely. U.S. and NATO bases in Europe prepared for possible air strikes in Kosovo and for support to the inevitable following flow of refugees. A series of operations followed: Joint Task Force (JTF) Sky Anvil, Noble Anvil (later called Allied Force), and Shining Hope (Clark, 1999; Robb, 2001; Taylor & Casey 2000). Reinforcement of USAFE forces continued. Eight B-52 bombers deployed from Barksdale AFB, Louisiana to RAF Fairford, UK, and twelve F-117A Nighthawks arrived at Aviano Air Base, Italy, along with other fighter-bomber squadrons, to augment expeditionary air groups already stationed there (Palmer, 1999).

U.S. Envoy Holbrooke again attempted to mediate a peace accord agreement that allowed Kosovo some autonomy. However, the Serb parliament rejected his efforts and spurned a NATO demand to insert its troops on the ground to insure peace in the region. On March 20, as the Serbian army assembled more troops in the area, all 1,380 international monitors withdrew from Kosovo into Macedonia. Following this failure of peaceful diplomatic initiatives, NATO issued orders on 23 March 1999 for the first air strike in its fifty-year history (Hayward, 1999).

Allied forces attacked the former Republic of Yugoslavia the next day. NATO aircraft from several nations initiated coordinated operations that resulted in their shooting down three Serbian MiG-29s on the first night of action. The air offensive included attacks by fighter-bombers flying from Aviano Air Base, Italy and RAF Lakenheath, England, among others. At the height of the ensuing campaign, the proportion of USAF aircraft—44%—committed to the campaign equaled similar commitments during the Vietnam War and Operation Desert Storm (Richter, 1999). In all, about 305 strike aircraft from thirteen NATO nations joined in Operation Allied Force (D.J. Robb, oral presentation, AsMA, 2001; see footnote 90 above).

B-2A Spirit bombers from Whiteman AFB, Missouri made their operational debut over targets in the Balkans. They joined their stealth counterparts, the F-117s based at Aviano, in precision-guided ordnance assaults on Serbian targets. Because the B-2s were flying 29-hour round-trip missions from their home base in Missouri, they received four 45-minute mid-air refuelings. The crews had to report for flight planning and briefing as much as six hours before takeoff, resulting in 35-hour duty days. This operational schedule routinely required the fliers to exceed standard crew rest requirements (Taylor & Casey, 2001, p. 22). Some B-2 crews began their flights at the nadir (low point) of their circadian rhythms following several days of working less than optimal duty/rest schedules. Flight surgeons deemed it impractical to attempt to adjust the crews' circadian rhythms, since they launched and recovered at their home station. Current Air Force level guidance did not authorize the use of stimulant medications on these B-2 missions. Even though aircrew had undergone fatigue management training, they sometimes reported "great difficulty in staying alert, especially during prolonged low-tasked periods of flight. In addition, certain critical phases of flight such as night aerial refueling occurred late in the mission at circadian nadirs for the

pilots" (AWOS, p. 21).[91] Whiteman flight surgeons responded to the situation by reserving on-base billets to facilitate preflight crew rest:

> Mission planning and preparation were altered to allow as normal a sleep schedule as possible for the pilots the 3 days prior to launching for a mission. Most pilots felt the use of no-go [sedative] pills the day prior to launch would be beneficial. Periodic training of aircrews on fatigue management was helpful. The use of fluids, high protein snacks, caffeine, and the chance to talk with other individuals all helped to maintain alertness. While these were all helpful, there were still significant problems, not the least of which were aircrew nodding off at unplanned times. It is evident that these missions can be flown much more safely if we include stimulant medication (i.e. go pills) as an option for the aircrews as an additional tool to combat fatigue on this type of mission (AWOS, p. 141).

The flight surgeons concluded that all aircrew members should receive fatigue management training for their specific type of aircraft and mission, given at the time of qualification in their aircraft and then repeated periodically at unit flying safety meetings. Further, the flight surgeons recommended that the USAF establish a written policy allowing the use of stimulant medications when necessary on extended missions (AWOS, p. 141).

A week after the air campaign began, B-1B Lancers deployed from Ellsworth AFB, South Dakota to RAF Fairford, UK. Their appearance over target areas marked the first time the Air Force had used B-1s, B-2s and B-52s in one combat operation (Hayward 1999; Palmer, 1999). In all, 16 bombers deployed into the NATO Alliance forces, a number that does not include the B-2s flying from Whiteman AFB. Some 175 tankers deployed to support the attack forces, which grew to include 253 fighter aircraft (16th AF, 1999). USAFE headquarters delegated to its squadron or group commanders the discretion to authorize flight surgeons to fly as medical observers on B-52 and KC-135 sorties; CNN reporters were also allowed along on such missions (AWOS, p. 9).

Incoming temporary duty (TDY) units augmented the USAFE-assigned (permanent change of station, or "PCS") forces. Aviano quickly doubled its population and tripled its aircraft, a situation reminiscent of the B-52 buildup at Andersen Air Base, Guam in 1972 for Operations Linebacker I and II. Aircraft from the U.S., the UK, Spain, Portugal and Italy conducted joint allied flight operations from Aviano. Base officials billeted the TDY troops in tents, reclaimed trailers, dormitories and sports facilities, and converted a newly completed administrative building into sleeping quarters for 125 personnel. The deployment buildup resulted in the usual problems with housing, feeding and waste disposal. Public health technicians made rounds twice a day to assure proper sanitation, latrine discipline, water safety and vector control (Brannon & Klein, 2001; see also footnote 90 above; Parsa & Kapadia, 1997).

"Soon, aircraft were taking off day and night to drop bombs on Serb targets. The high mountain peaks near the base echoed with the roar of jet afterburners. Airmen worked 14 to 16 hours a day, six or seven days a week" (Barradas, 1999). Many fliers received billets in downtown contract hotels in order to assure more restful conditions (Brannon & Klein, 2001;

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[91] Some information about the Air War Over Serbia (AWOS) in this paper derives from data provided to the authors by the office of the Surgeon, United States Air Force in Europe (USAFE/SG) in 2001 on a CD-ROM, "AWOS Analytical Baseline Database." Please see the footnote following the References below.

see also footnote 90 above). The noise of the sustained air operations was a major irritant to those living on base, sometimes reaching the proportions of an occupational hazard in sleeping areas. Troops that were billeted on base coped as best they could:

> It was remarkable how fast this community had been put together. The haste in which it was sited and constructed left little chance for any preventive medicine review of the plan for the camp. Of course, it would not have mattered much if there had been a review since there was only one place to build it. But being near the departure end of the runway meant a significant noise exposure for everyone who lived there. Almost all areas of the camp had an 8-hour [decibel level] over 85 [90 is the maximum industrial hazard exposure allowed without ear protection]. We had people wearing earplugs on and off duty...Being permanent party didn't eliminate the need for good field preventive medicine and it was a credit to HQ USAFE that they sent us extra help [bioenvironmental engineers and preventive medicine technicians] to deal with just these types of issues (Klein, 2000).

The use of permanent base facilities such as Aviano for combat operations led to a spectator atmosphere as thousands of sightseers—some of them with antiwar posters and chants, others representing the media—lined the base's wire fence each day to watch the takeoffs and landings of jet aircraft flying tactical combat missions over the Balkans. The resulting lack of privacy led to so many complaints by troops billeted in nearby tent cities that base authorities had to construct a curtain wall to hide the temporary dwellings from outside onlookers ("No more peeking," "Air Force Times," 26 Apr 1999; Brannon & Klein, 2001; see also footnote 90 above).

Aircraft crews permanently based (PCS) in Europe flew many Alliance strike missions. Some of these fliers and their families lived on their bases, and some lived off base in local communities. USAFE officials termed combat operational sorties flown from such bases "in-place fighting" (AWOS, p. 30), but other authors dubbed it a "commuter war" (Richard & Huffman, 2002). The presence of these families represented a challenging situation for USAF Alliance aircrew and their squadron flight surgeons. We have seen that other USAF fliers had flown under similar circumstances in the past. B-52 crews flew strike missions over Southeast Asia 27 years earlier from Andersen AB, Guam where they resided with their families (Farmer, 1973; McCarty, 1979, pp. 12, 91; Moser, 1975, p. 8). Other aircrew had flown combat missions from their home bases in the attacks on Grenada and Panama from CONUS bases, and in Europe from Lakenheath and Upper Heyford during Operation El Dorado Canyon in 1991.

Aviano flight surgeons, their numbers augmented by TDY flight surgeons, supported sustained round-the-clock combat operations. Since many units had only a single flight surgeon assigned, medical authorities at Aviano provided coverage for after-hour operations by converting a local gymnasium into a 24-hour medical facility, and by opening a flight line dispensary. Two TDY flight surgeons and six PCS flight surgeons furnished aeromedical services at this facility, and all "did a standout job, " as did the five TDY non-flight surgeon physicians who took care of the non-flying personnel (Klein, 2000). The permanent Aviano base hospital provided second-line medical care, and the northern Italian hospitals, along with civilian ambulance and air ambulance services, furnished further medical and trauma backup (Klein, 2000; Brannon & Klein, 2001; see also footnote 90 above).

At the same time, Aviano flight surgeons continued to support the families of their PCS fliers:

> Family members often kissed their military loved ones good-by at home knowing that their husband or wife was flying into harms [sic] way, coming face to face with anti-aircraft artillery and surface-to-air missiles, in just a matter of hours. As a result, the medical facility personnel worked closely with chaplain and family support services to provide strong proactive programs to address the unique stresses placed upon family members (Brannon & Klein, 2001).

One Aviano fighter squadron commander described the situation on 24 March directly:

> As my jet powered up, about 15 minutes away, I knew my children [a daughter, 11, and a son, 7) were sound asleep. I was also just as sure my wife [an active duty Air Force officer] was not. She knew something our kids didn't. I was going to war....When we flew back to Aviano, we were all still pretty hyped up. I promised I'd call [her] when I got back, and I could hear the relief in her voice. That morning at breakfast she'd told the kids that I'd flown on the bombing mission but had gotten home safely. She didn't want them to hear about it at school or on TV...That was one of the unique aspects of this conflict. We were fighting a war from home. After flying a night mission, I'd usually make it home in time to see my kids off to school. Then I'd sleep from about 8 a.m. to 3 p.m. I'd wake up in time to meet them at the bus stop...We'd get home, they'd start homework, and I'd try to get some exercise. Then mom would come home from work, and one of us would drive them to swim lessons...a lot of times during the war, I just had to drop them off and head to work...
>
> Having maintenance and support systems in place were a major advantage of fighting a war at home. On the flip side, fighting from home is hard emotionally. Some families struggled with sending daddy to war every day. [My wife] told me the ladies as a whole didn't get a lot of sleep when their guys were flying night combat missions. There was a lot of praying, a lot of crying and a lot of comforting each other on the phone.
>
> There's a lot of emotional baggage of having to say goodbye to a loved one every day when you know he's going into combat. It was hard on the wives. We [pilots] tried to keep things normal, but the fact was we weren't around much. And when we were around, it was mostly to sleep, eat, shower and shave (Nichols, 1999).

The wife of another pilot in the same squadron noted, "Part of me feels like it's unfair because my life has been taken away from me, but then I look at the big picture...I'm prior military—I'm not naïve. I know what he signed up for. But part of me wants to be selfish about things like, 'Is [our daughter] going to be able to see her daddy today?' The threats are real" (Furry, 1999). The possibility of loss, day after day, is real. When a shoot-down or a mishap occurs, the family members who have just lost their spouse or parent must not only face their grief but may also have the considerable emotional stress of leaving a familiar and supportive on-base environment and moving back to the U.S. within a short period. Squadron mates and family members always support and help these families, but such help confronts the helpers with the possibility that they may be the next to need it. These circumstances can lead to a particularly stressful mixture of personal identification with the grieving survivors, and a guilty sense of joy that, "I was not the one to die," or to sustain the loss of a loved one. (Jones, 1982).

Flight surgeons at fighting-in-place bases noted that these fliers had all the stressors of combat "and then some." Problems included fatigue due to changing shifts and long hours, circadian disruption and little sleep and family problems stemming from the little time that

families had together, and from irritability and fatigue when they were together. Families also had concerns for life and limb, decreased communication, and a sense of being overwhelmed by circumstances (AWOS database, pp. 39-41, 149).

The outreach contributions of an assigned aviation-trained clinical psychologist proved valuable in squadron support and in family matters. Flight surgeons involved in family counseling learned not only to listen for purposes of ventilation and interpretation, but also to offer information about the role of the family in contributing to the flier's effectiveness and safety (AWOS database, pp. 39-41, 149). Flight surgeons can also provide follow-up information about fliers or family members who have been transported by air evac to other locations to those remaining at the home base (Jones, 1972). In this regard, commanders and medical authorities faced one problem not previously encountered. The sustained operations tempo, which imposed problems of sleep discipline and fatigue upon all personnel, provided particular stresses for single parents on active duty at Aviano (Furry, 1999, pp. 6-7). Although official reports gave no details, the need for "strong proactive programs" mentioned by Brannon and Klein is clear in responding to such situations in today's Air Force (2001). No explicit answer to this problem emerged during the AWOS; post-action analyses mentioned on-duty "combat naps," careful scheduling and *requiring* off-duty personnel to leave the workplace and rest.[92] Commanders and first sergeants also spent some time with family groups discussing the current situation and stress management issues (AWOS database, pp. 36 ff).[93]

A retrospective cross-sectional study investigated the comparative stress experienced by TDY and by PCS combat aviators, although it yielded no definitive answers. The investigators, one a flight surgeon and one a biostatistician, surveyed 42 PCS or TDY aviators assigned to an overseas fighting-from-home base, using a third group of 15 CONUS aviators as controls. The authors proposed two null hypotheses: 1) that no fliers in any of the groups would show signs of excessive stress, and 2) that there would be no disproportion in reported stress between the various squadrons. Results of the study rejected both hypotheses at statistically significant levels. Many fliers had significant symptoms of stress: 89% described insomnia, 86% irritability, 63% dissatisfaction, and 61% fatigue, for example. However, stress levels were relatively low among the 11 fliers in an overseas PCS squadron that was "successful in the mission and...rewarded with many opportunities that seemed to 'come their way.'" Stress levels were higher in 14 members of a PCS squadron that "seemed to have 'hard luck.' The squadron experienced a non-combat related fatality...6 weeks before testing. They never seemed to be in the right place at the right time when it came to mission opportunities" (Parsa & Kapadia, 1997).

The stress levels of a group of eight TDY fliers fell between the levels of these two PCS squadron representatives, as did those of the 15 CONUS control fliers. The authors stated that these results "can only provide a glimpse of the subject" of combat stress and the

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[92] Recent NASA research has confirmed the value of ten-minute naps in flight as a means of restoring a crew member's alertness (Neri, et al., 2002).

[93] During the Vietnam era, some CONUS bases from which units had been deployed into combat provided daily briefings in the base theater on the war situation for family members who wished to receive up-to-date information (experience of DRJ).

presence or absence of family support and concerns (probably due to the small number of subjects), and called for additional research (Parsa & Kapadia, 1997).

Perhaps the personal observations of Major Brian B. Parsa, USAF MC, a RAM flight surgeon assigned to the base, are more germane. He noted that the PCS pilots reported a feeling of stress and strangeness upon returning from combat missions to their families. This contrasted with the experiences of the TDY aircrew, which included previous stressful circumstances that Parsa described as being subjected to "microstressors." These included long absence from family members, due in part to a series of preceding TDYs to other locations (Parsa & Kapadia, 1997; Richter, 1999). Another flight surgeon viewed this sort of situation somewhat differently:

> The aircrew were holding up remarkably well. We had a sense that we could have kept up the 80-hour weeks for another several months without getting burnt out. Everyone was getting a day off now and then to get their batteries recharged, which was much more effective for the permanent party personnel who had their families close by. Initially it seemed the TDY personnel had an advantage in this regard since they didn't have the normal distractions that you get at home. This was true for the first couple of months, but after that you could tell that they were anxious to get back home and probably had more distractions than the personnel stationed at Aviano (Klein, 2000).

Most families of PCS fliers adjusted quickly to the new routines. The fact that rescue teams picked up the two fliers shot down (one F-16 pilot and one F-117 pilot) and returned them safely to the base within a few hours provided great reassurance that the allies would spare no effort in such circumstances (Nichols, 1999). Brigadier General Daniel P. Leaf, commander of Aviano's 31st Expeditionary Wing, gave credit to the fliers' families living there for the way they withstood the stressors involved in having their pilots come home to them after flying operational missions. The pilot of the downed F-16 was one such flier:

> When the MC-130 Combat Talon brought the rescued pilot back to Aviano, the airman's wife was standing next to Leaf as her husband walked onto the tarmac and up to the general. "[Leaf recalled his conversation with the couple. The pilot said], 'Boss, I want to fly tomorrow night.' I said, 'You can fly when she's ready.' He flew two nights later. It's a tribute to an Air Force culture that builds that kind of family" (Rolfsen, 2001).

In the end, the Aviano hospital commander agreed with Klein's observation that the PCS fliers felt they were better off than their TDY counterparts because they did not have to face the "when do we get to go home" homesickness felt by all deployed troops at the end of the day (Brannon & Klein, 2001; see also footnote 90 above).

The USAF aerospace clinical psychologist assigned to Aviano, Major London S. Richard, Ph.D., supported both the families and the combat units there. He undertook to gather objective data comparing the reactions and effectiveness of PCS and TDY units. Although he had difficulty in obtaining the necessary authorizations under the press of operational demands at all levels of command, his work did result in a peer-reviewed publication (Richard & Huffman, 2002; London S. Richard, Ph.D., Maj USAF BSC, personal communication to DRJ, 30 November 2001). This difficulty in initiating research reflects the experience of Rayman and others during their one-year SEA tours during the Vietnam War. The time necessary to complete the required documentation and obtain the proper

permissions put most would-be investigators close to the ends of their tours, so that they could not do the work (Russell B. Rayman, MD, MPH, Col USAF MC [Ret.], personal communication to DRJ, 2000).

Accounts of medical and aeromedical support to families at Aviano during the AWOS exemplify several useful principles:

1. Flight surgeons should be available to furnish primary care to the families of aircrew who wish to use this service. Since many aircrew families use flight surgeons as their "family doctors" in peacetime, this familiar source of care and counsel is even more supportive during combat operations.
2. When consultation with medical specialists is required, flight surgeons can act as "medical advocates" for the families in the same way that they do for the fliers. Flight surgeons can also provide follow-up information about fliers or family members who have been transported by air evac to other locations to those remaining at the home base.
3. The knowledge that flight surgeons are caring for their families may relieve fliers of concern about the well being of their loved ones.
4. Coordinated activities of commanders, chaplains, family service representatives, flight surgeons and aerospace psychologists can communicate accurate information to families. They can answer questions in a non-threatening and convenient setting, and bolster family support for the fliers through education about proper eating habits, crew rest (changing shifts and long hours, circadian disruption) and stress reduction (little time together, irritability and fatigue when together, concerns for life and limb, decreased communication, and the sense of being overwhelmed by circumstances).

People involved in combat operations will always be busy. *The lesson is that recording and analyzing current events is a full-time job for a historian, and should not become an additional duty for those involved in combat operations.* The orderly establishment during peacetime of an administrative mechanism for recording such information and for implementing clinical research such as that undertaken by Richard and Hoffman would allow such projects to be undertaken as operational aeromedical team members identify them in combat situations. For example, in addition to the matter of the operational effectiveness of TDY and PCS fliers, one might examine the effectiveness of fliers operating from bases where alcohol consumption is strictly controlled in deference to local authorities (as in Saudi Arabia during Desert Storm) and where it is not (many other locations). Another such project might compare various methods of handling stimulant and sedative medications under conditions of combat. Such prior planning has allowed for similar research during civilian and military disaster relief actions, and might serve as a model for research into aeromedical combat operational support as well.

In some cases, newly deployed TDY aircrew might be required to fly as soon after their arrival as they could turn their aircraft around and receive a mission briefing, without time for acclimatization. This circumstance, which had occurred as far back as the USAF deployment to Mediterranean area bases during the Lebanese crisis in the Eisenhower

administration,[94] happened again during the AWOS. It will undoubtedly occur in future conflicts. In the most recent wars, line commanders waived the usual flying hour maximums after obtaining medical consultation (viz. Rayman, 1993). With headquarters approval, flight surgeons during the AWOS used medications, generally temazepam or zolpidem as sedatives and sometimes dextroamphetamine as a stimulant, for circadian adaptation.

From USAFE Headquarters down to base level, commanders emphasized the need to avoid aircrew casualties:

> A number of newspapers reported that NATO's [Supreme Commander General Wesley A.] Clark had issued an unprecedented order at the outset of the conflict that there be no Alliance casualties in the conflict—and that commanders were to avoid losses at all cost. [The operational commander of the Alliance air campaign, U.S. Air Force Lt. Gen. Michael C.] Short denied that Clark had ever given him any such order. However, he acknowledged that zero losses was a major goal (Tirpak, 1999).

Whatever the nature and local understanding of this policy, it proved to be a bonus to the medical effort in terms of line support for medical needs, since unit commanders understandably wished to minimize the consequences of any aircraft losses that might occur.

Deployed flight surgeons encountered some of the same problems at "bare bases" that had plagued their predecessors in other wars. Tents, tent heaters and other basic non-medical equipment items were in poor repair. Some medical personnel who had been called to active duty from non-medical civilian jobs were not current in required skills, or lacked proper documentation, certification or training (e.g., physical fitness, security clearances, resuscitation courses, drivers' licenses, or the ability to drive vehicles with standard transmissions) (AWOS database, 2001, pp. 27-28).

Lt. Col Bruce R. Guerdan, USAF MC, an Air National Guard flight surgeon, faced considerably different challenges from the flight surgeons who supported the massive buildup at Aviano, an established NATO base. With only three days' notice, he and his Air National Guard squadron of KC-135 refueling tankers deployed from their home location at Pittsburgh, Pennsylvania to a stand-alone assignment in Budapest, Hungary. This squadron thus became the first U.S. unit to establish operations in a former Warsaw Pact country.

Hungary, which had only recently joined NATO, had suddenly found itself part of an international alliance engaged in attacking its aggressive southern neighbor Serbia, with which it shared a border. None of the deploying Americans was certain about their reception in Budapest under these sensitive conditions.

Guerdan's task was to turn the USAFE site-survey plan into an "expeditionary reality." As the unit was preparing to depart for Hungary, Guerdan learned that he had the usual "minimal footprint" transport space, less than one deployable pallet (about 10 feet square)

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[94] Experience of DRJ; at least one severe ground injury occurred under these circumstances. A navigator, tired after a long transatlantic flight followed by a local operational mission and frustrated that no "Follow Me" truck was available, exited his aircraft to direct his pilot into a parking area. He fell into a deep refueling pit while walking backward in front of the taxiing aircraft.

on which to transport his supplies and equipment to the squadron's medically uncertain destination. He informed the unit of this limitation imposed upon their sole on-site medical support, and the squadron quickly arranged space for a full pallet of medical supplies. Guerdan offered this as an example of "thinking expeditionary" and involving the unit in contributing to its own care (Guerdan, oral presentation, 2001: see footnote 90 above). Upon arrival in Budapest, he learned of a commercial terminal building that had recently emptied when a new terminal was opened. He sited his Squadron Medical Element facility in the deserted facility, thus obtaining not only indoor rooms, but also running water and flush toilets. His clinic furnished round-the-clock ("24/7") primary medical and aeromedical care to some 700 troops working at two sites during their entire 270-day deployment. Faced with three potential chains of command, he used whichever seemed most responsive to a particular issue or need, and sent information copies to the other two (AWOS database, 2001, p. 3).[95]

Since no other NATO or allied forces had deployed to that location, Guerdan had no source of medical backup: neither the U.S. nor NATO had an official Memorandum of Understanding with Hungary concerning the unit. He contacted the military attaché at the American Embassy, who introduced him to local civilian and military medical officials. Through their efforts, he arranged for medical specialty backup (e.g., orthopedics, radiology) and dental care for his troops. These arrangements were a "first" for the former Soviet bloc country. As flight surgeons in other deployment locations soon recognized, working with local medical practitioners and facilities in caring for USAF personnel required "deployment etiquette," a sensitivity for local medical customs and a courteous demeanor that avoided any aura of demanding or patronizing behavior (AWOS database, 2001, p. 4).

The time will come again when flight surgeons must depend upon host country civilian or military medical facilities for inpatient or specialty medical care or consultation. *At times flight surgeons may have to compromise their usual practices. Courtesy, diplomacy, and an understanding of local customs and expectations are invaluable assets in such situations.* At a less stressful level, coordination between U.S. military services may also serve to fill professional needs. Here, personal contacts between physicians—courtesy visits, exchanges of call roster responsibilities, mutual support in exchange—may ease the burden. With the smaller medical corps of today's armed forces, it is possible that some of the physicians will have trained or served together previously, and friendships formed during inter-service programs may have unexpected benefits in deployment situations.

Guerdan's other innovations involved getting a rental car for transportation, trading supplies with local army units, and using local purchase funds to buy necessary items in Budapest. He also augmented normal supply channels with items shipped from his home base location in Pittsburgh by Federal Express, a system that furnished two-day service. He summarized his experiences: think ahead about people, equipment and supplies; get rid of any peacetime

[95] At a "lessons learned" meeting after the war, attendees agreed that the published medical chain of command should be furnished to any deploying unit prior to its departure for its operational location. They also stressed the value of inter-service medical support and cooperation at the local level, echoing the lessons learned in Vietnam (AWOS database, 2001, p. 48).

corporate mentality and "think expeditionary. Stay ready and stay flexible" (Guerdan & Klein, 2001; see also footnote 90 above).

Tactical fighter and fighter-bomber aircraft routinely flew missions over Kosovo lasting five hours or more. Some of these missions also involved complex aerial refueling profiles, flying at night under blackout conditions, and special operations with night vision goggles. As in previous combat operations, flight surgeons flew as aeromedical observers on many different flight profiles. For example, Aviano USAF flight surgeons logged the following flight time (data from William B. Klein, Lt Col USAF MC in personal correspondence to DRJ, 30 September 1999):

Table III. Combat hours flown by Aviano flight surgeons

Flight Surgeon	Sorties			Total Hours
	F-16	EA-6B	EC-130	
Lt Col K	7	0	0	41.2
Major B	9	0	1	69.9
Major S	3	0	0	16.8
Capt U	5	0	0	29
Capt S	4	0	0	20
Capt H	0	0	20	24

Klein outlined the policy at Aviano under which flight surgeons flew as medical observers on combat missions:

> The flight surgeons were not allowed to fly over Belgrade. Just as Wing Commanders in Vietnam had restricted the types of missions flight surgeons could fly, so our wing commander had done. I had never really objected to this, as it was [a] reasonable risk management decision. Certainly we did not have to fly over the Serbian capital to gain a good appreciation for combat fighter operations. The CAP [combat air patrol] missions were more demanding from a human factors point of view, since they tended to be six to eight hours in length which was twice what the bombing missions were. The sortie I was on...would end up being 7.5 hours. It became apparent early in OAF [Operation Allied Force] that it was fatigue, sleep hygiene, and circadian dysrhythmia that were the human factors of import. The use of "go" pills, which were so critical during the first few weeks of the campaign, had dwindled down to nothing. We were lucky that we had an SG and SGPA (Command Surgeon and Chief Flight Surgeon) at HQ USAFE that had a grip so that when the operators asked for the "go" pills we were able to deliver. The pilots were assigned to days or nights and were now accustomed to their flying "shift." Acceleration and spatial disorientation, topics that I had spent so much time learning, were never factors during this mostly night vision goggle war. Unfortunately, I was not as familiar with fatigue issues as I needed to be. I did, however, have a good library and a group of flight surgeons at Aviano who were much smarter on this stuff than me. And because of their hard work we got our fatigue countermeasures program on-line prior to the start of hostilities (Klein, 2000).

These and other comments by Klein on the value of flight surgeons flying as medical observers in combat aircraft speak of what he termed the "outstanding leadership" at Aviano. He did not have to convince his commander of the value of such flights, and the after-action reports from Aviano and other locations attest to the results in flying safety and operational effectiveness deriving from flight surgeon participation in appropriate missions. "After all, that was what we were paid to do, the precedents were there, and it was

conveniently spelled out in AFI 11-402, Chapter 3" [the regulation covering flight surgeon flying activities] (Klein, 2000).

The sustained operational tempo of the war required particular attention to fatigue countermeasures programs. USAFE medical and line officials praised several young flight surgeons who independently collected data on the effects of the low crew-to-aircraft ratios on decreased circadian efficiency. Having too few crews per aircraft for the ongoing round-the-clock missions had resulted in rotating crews through several shift schedules in succession, a practice known to diminish alertness and performance. This occurs because a flier who must fly on day shift for several days, then on an evening shift schedule followed by a night shift schedule is not able to adapt to the necessary body rhythm changes of sleeping and wakefulness. Increasing the number of crews per aircraft allowed a more orderly separation of the units into day fliers and night fliers, an approach that Klein mentioned in the Aviano fighter squadrons. Capt. Donato J. Borrillo, USAF MC FS, among others, took personal initiative in collecting the necessary data on the flight schedules of his tanker crews that demonstrated the need for an increased number of crews per aircraft:

> Careful use of medication for specific circadian rhythm issues was...accomplished by the flight surgeons. Flight surgeons at two different bases performed fatigue assessment surveys on their tanker aircrews early in the conflict. They discovered that the ATO (Air Tanker Operations) cycle was causing circadian rhythm phase shifting of approximately six hours every day (resulting in changing from day to night and back to day missions every 5 days) causing severe fatigue. The flight surgeons reported this to their line commanders and to the USAFE [line and medical authorities], who acted to increase the deployed aircrew ratio from 1.3 to 1.8 per aircraft. Follow-up surveys revealed this increased crew ratio allowed a more predictable flying schedule and significantly decreased fatigue and therefore the risk of accident or incident—a real success story! (Taylor & Casey, 2000, pp. 22-3).

Aircraft from separate CONUS locations converged upon several European bases to form "rainbow units" made up of squadrons or elements that had never flown together before. For example, in May 1999 Air National Guard A-10s from Massachusetts, Idaho and Michigan deployed into austere base conditions at Trapani Air Base, on the west coast of Sicily. Designated the 104th Expeditionary Operations Group, the A-10s began flying strike missions over Kosovo within two days of their arrival (Hibberd, 1999). Here and at other locations, flight surgeons found themselves furnishing aeromedical support under the acute stresses of combat to fliers they had never met. In some ways, such situations resembled the assignment of Wilmer and his group of novice flight surgeons to support American fliers at Issoudun, France in 1918. The same aeromedical principles applied: newly-assigned flight surgeons and their flying units learned to work together in pursuit of the common purposes of operational effectiveness and flying safety.

Classic aeromedical practices smoothed this bonding: having the flight surgeon fly with the aviators as an observer, having the flight surgeon live, eat and associate with fliers in non-flying situations, having the flight surgeon serve as a member of the unit commander's staff, and having the flight surgeon coordinate any medical care given to the fliers by non-aeromedical consultants. The process was easier if the flight surgeon was already experienced in aerospace medicine. When the bonding proceeded properly, the fliers came to regard the flight surgeon as a fellow flier, one of "us" rather than one of "them" (Douglas J. Robb, Lt Col USAF MC, personal communication to DRJ, 4 June 2002). Activities that

facilitated this bonding fell into three general categories: *professional*, *social* and *flying*, but the three merged into a constant state of aeromedical awareness on the part of the flight surgeon.

Professional activities include both traditional medical duties and the duties of the flight surgeon as a member of the commander's staff. In the former capacity, the flight surgeon should offer convenient primary medical care, and should coordinate any care given by consultant physicians. In the staff-member capacity, the flight surgeon must be constantly alert to human factors aspects of everyday decisions about flight and base operations. Of note is the fact that aeromedical care is best given by flight surgeons assigned to specific flying units who are primarily responsible to the unit commander, rather than to local medical facility commanders who can preempt their services.

Social activities include interpersonal, non-medical interactions between the flight surgeon and the fliers. One experienced flight surgeon offered several suggestions about this process. A newly assigned flight surgeon should learn the particular jargon of the new unit and its aircraft, but should not attempt to use it until mastering it; mistakes can "make you look stupid." The flight surgeon should listen to learn, and ask questions to clarify. One way to do this is to spend time in the Operations area, both to observe and to be available for informal consultation. The flight surgeon should eat meals with the crewmembers as much as possible, and should join in their off-duty activities. Flight surgeons who are private pilots or former military pilots should be careful to stay in their role as aeromedical observers, and avoid second-guessing aircrew activities and decisions. Flight surgeons who try too hard to involve themselves in the duties of individual crewmembers may disturb or even irritate them (Bruce R. Guerdan, Lt Col USAF MC, personal communication to DRJ, 27 January 2002).

Flying with the unit, or (if unit aircraft could not accommodate flight surgeon participation) with nearby units, was, as always, essential to the flight surgeon-flier relationship. USAF regulations require flight surgeons to have proper documentation and proficiency training before flying as observers on any aircraft. Some flight surgeons in the Balkan campaign had never flown in their new units' aircraft types, were not qualified to do so, did not have appropriate security clearances or did not have the proper personal equipment. Some locations had several different aircraft types, and flight surgeons had training and equipment for one aircraft, but not another. Orders and policies aside, aircrew members were understandably reluctant to allow relative strangers to fly with them under stressful conditions (AWOS database, 2001, pp. 174-5). Some flight surgeons estimated that establishing the proper professional rapport and mission familiarity within a squadron took about two weeks. However, reflecting the experience of previous conflicts, once the full relationship was established, the aircrew appreciated their flight surgeons flying with them:

> ...I was able to better judge fatigue, morale and gain the trust of the crews assigned [to my squadron] from other units. There is no better way to become accepted by the crews. (Bruce R. Guerdan, Lt Col USAF MC, personal communication to DRJ, 30 September 1999)

> The aircrew felt that it was [excellent] that the docs were flying, and certainly I felt that I had a better connection with the pilots as well as the commanders, so that when I talked to them about how to schedule

pilots to minimize fatigue, they listened because they knew [that] I knew what I was talking about. (William B. Klein, Lt Col USAF MC, personal communication to DRJ, 30 September 1999)

NATO and the Serb government signed a joint Military Technical Agreement on 9 June 1999, 78 days after Operation Allied Force had begun. NATO officials suspended air combat operations the next day and augmented its humanitarian relief of the thousands of Yugoslav refugees in Macedonia and Albania, Operation Allied Harbor. NATO also began to implement its original aim in March 1999, the deployment of its Kosovo peacekeeping force (KFOR). The NATO Alliance had achieved clear air superiority, having destroyed over 90 Yugoslav aircraft (six in flight). Alliance forces had grown to include 912 aircraft and 35 ships; the aircraft had flown 37,465 sorties, including 14,006 strike missions (Clark, 1999) and some 11,000 airlift sorties (Robb DJ, oral presentation, AsMA, 2001; see footnote 90 above). Support missions thus outnumbered strike missions by a greater proportion than in previous air campaigns This fact reflected the need for ongoing protective air cover, the long distances between home bases and targets that required a high number of tanker sorties, and the support of reconnaissance and airborne early warning and control aircraft. According to the NATO commander, the campaign had been "the most heavily leveraged [i.e., aerially supported] air campaign yet seen" (Clark, 1999, pp. 16ff).

Conclusions and Lessons Learned

The final medical report on the Air War Over Serbia cited work schedule adjustments, billeting changes, and rest cycle management as being vital keys in the close work of TDY and PCS flight surgeons with the line leadership at all levels. This teamwork contributed to combat safety and effectiveness so that, probably for the first time in the history of sustained U.S. air combat operations, no American fliers died in combat or in crashes (Taylor & Casey, 2000, p. 22). The official reports of the medical services after the Air War Over Serbia included "Lessons Learned" that applied not only to flight surgeons but to all medical personnel. Some of these general lessons follow:

1. Air Force medical personnel need arms training and proficiency, not only in simple marksmanship, but also in the physical management of firearms in a combat theater. Anyone to whom the Air Force issues a gun and ammunition should receive simultaneous instruction in the Rules of Engagement, since having a loaded firearm in combat includes the responsibility for deciding whom to shoot:

Shooting the gun at the range did not transfer well to loading, carrying, or being prepared to use a loaded weapon in defense of patients and self. The troop commander had to spend several hours on many occasions demonstrating loading, chambering, unloading, and disassembling the weapons; carrying loaded weapon with a bullet chambered, gun off safe, hammer down, etc. Many AF troops asked what to do if shot at by snipers, confronted by armed aggressors, how to disable aggressors, etc. In short, they were probably not weapons-competent although they were weapons-qualified (AWOS database, 2001, p. 24).

2. Physicians may take aeromedical evacuation for granted in peacetime. All military physicians, not just flight surgeons, should understand the functions and limitations of tactical and strategic airevac in combat. This is crucial in an environment where ground fire against slow-moving transport aircraft is possible. Physicians should also understand the use and limitations of retro-airlift when formal airevac is not

possible, particularly when local medical personnel untrained about inflight medical care must accompany the patient. Time after time, return of these medical personnel to their parent units has proved to be a problem.

3. Regrettably, medical resupply will have low priority early in a contingency operation. Narrative accounts from many deployment locations speak of the need for original thinking in dealing with this predictable problem.

4. Similarly, medical communications will have little initial priority. Flight surgeons should deploy with their own communications if possible, even if only a dual-channel ambulance net with its portable radios and base station.

5. Bioenvironmental Engineering (BEE) resources are at their most crucial early in the deployment process when water sources and purification, sanitation, housing, vector control, and other such problems are first being identified and worked out.

6. Ongoing military training continues even on deployment. Units and individuals should take necessary documentation with them, including government driver licenses and comparable competency papers. Medics should routinely receive peacetime training in driving standard transmission vehicles as well as those with automatic transmissions.

7. When medical assets from several units deploy to a single site, the senior medical commander must be the sole authoritative source of contact with the local commander. Medical relationships under such circumstances may be difficult to work out, but a clear chain of communication, if not of command, is crucial.

8. Delegation of some administrative responsibilities to local medical commanders, including waiver authority (as with some medical conditions) will relieve both headquarters and local facilities of a great deal of communication and paperwork. Such delegation is adaptive in acute combat support situations. Deployed medical units can return to peacetime administrative protocols when affairs settle down after a few months.

9. The changing tactical and logistical situation during the AWOS led to an atmosphere of continuing crisis management. This is usual in wartime. Senior flight surgeons had to attend local staff meetings in order to keep current, and to advise the commander when necessary. Although having physicians sit through meetings of line officers may seem a waste of valuable medical time, it is not. Some veteran line commanders understand military medical factors, but others have only a sketchy knowledge about such matters. Professional military education in the USAF provides little information about the subject to line officers. At times, only an experienced military physician can recognize the medical implications of a line decision made quickly when there is no time for formal staff coordination of paperwork.

10. Several attendees at the "Lessons Learned" medical meeting commented on the pressure that local commanders put upon them to furnish medical care to local civilians. Line commanders may not understand that civil law and military regulations delegate no discretion to military physicians to give medical aid to non-military persons, foreign nationals, and especially to refugees. To do so is directly contrary to U.S. Code Title 10, which specifies those who may receive care from USAF medical personnel. Only the Departments of State or Defense can grant exceptions to the U.S. Code. However, at times local conditions during and after the AWOS raised strong humanitarian concerns among line and medical officers alike, and both groups found that legal constraints on compassionate responses caused great personal distress. A conflict between conscience and law is always difficult. Seeing human beings in distress without offering help may contribute to later post-traumatic symptoms among military personnel. The reaction to a specific situation may simply depend upon individual decisions about right and wrong.

At the end of the Gulf War, the USAF Medical Historian wrote that Air Force medical assets had been used in that campaign to provide medical care to ground forces. His words would be echoed less than a decade later by the USAFE Surgeon, Col. George Peach Taylor, at the end of the Air War Over Serbia:

> It was very clear throughout the AWOS that the AF Line views the medics as units built and deployed to support AF needs. Contingency [medical units] are only begrudgingly allocated to support the medical needs of the other services (Taylor & Casey, 2000).

The protective attitude of the air force line authorities derived from the ready availability of its deployable medical assets. Air Force Medical Service readiness, with flight surgeons and their medical technicians at the tip of the arrow, had come a long way from the cobbled-together medical resources that supported the Berlin Airlift and the opening days of the Korean War. USAF medical personnel and facilities provided exemplary medical service during both the Gulf War and the AWOS, not only to the Air Force, but to other deployed U.S. military forces as well. Taylor regarded USAF *medical* deployment readiness for the Balkan air campaign as being five years ahead of USAF *line* deployment readiness (Taylor, oral presentation, see footnote 90 above).

Medical problems directly interfered with combat operations during the war in Vietnam; as a single example of a recurring difficulty, Udorn Royal Thai Air Base cancelled all its combat and combat support flights and essentially closed down for a day due to a food poisoning epidemic (experience of DRJ). A simple statistic sums up the improved quality of aeromedical planning and support of the air combat campaigns of the 1990s. *During the Gulf War and the Air War Over Serbia, not a single U.S. Air Force or Alliance sortie was lost for medical reasons* (Cohen, 1993, p. 230; Nanney, 2000; Taylor & Casey, 2000, p. 7).

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* Some information about the Air War Over Serbia (AWOS) in this paper derives from data provided to the authors by the office of the Surgeon, United States Air Force in Europe (USAFE/SG) in 2001 on a CD-ROM, "AWOS Analytical Baseline Database." Administrative sources (USAFE/SA) provided the original AWOS Analytical Baseline Database. The USAFE/SG study did not involve USAFE/SA, which has not reviewed the results. In that regard, the results should not be attributed to USAFE/SA. Opinions concerning the implications of this information and its possible applicability to future situations are those of the current authors (DRJ and RWM), and do not represent the opinion of the Department of Defense, the United States Air Force, USAFE/SA, or any other official agency. The current report will cite after-action reports from these data as "AWOS database."

CHAPTER 6

CONCLUSIONS

Historically, the need for care of the flier is the specific reason the Air Force has a separate medical service (Smith, 1953).

Summary of the Development of the Flight Surgeon Role

This Technical Report has proposed the hypothesis that professional services furnished by flight surgeons have had a demonstrable and measurable effect upon the safety, health and effectiveness of U. S. Air Force flying units in combat. We believe that the evidence presented in this historical review supports this hypothesis.

Before the entry of the United States into World War I, medical care for fliers in its few tiny flying units came from military physicians assigned without any specific training in the problems unique to aviation. The flight surgeon system that came into being in 1917-1918 in the continental United States was almost wholly concerned with selection of fit candidates for flying training. During World War I, combat fliers received essentially no aeromedical combat support as we know it today. Although Lyster developed a clear concept of what was needed, such concepts take time to achieve reality. One might draw an analogy between the development of a doctrine of the use of air power in combat and the development of a team of physicians to support the emerging air forces. Most of the flight surgeons assigned to the American Expeditionary Forces flying bases in Europe served in extensive "laboratories" at rear-echelon bases. The few flight surgeons assigned to direct support of specific flying units served at large training centers in France rather than with operational squadrons at the front. However, the success of those first unit-assigned flight surgeons led to plans at the Medical Laboratory at Issoudun, France to train physicians already in theater as flight surgeons and assign one to each combat squadron. The war ended before the Medical Service could put these plans into action. As far as we have been able to determine, although U.S. training squadrons overseas did receive some aeromedical support, U.S. air combat forces did not receive any aeromedical support at the squadron level *from trained flight surgeons* during World War I. This fact is implicit in previous literature, but has never been explicitly stated before. Further, during that conflict it appears that no other national air forces received flight surgeon care as we understand it today.

Aviation medicine here and abroad languished after the war. The School of Aviation Medicine narrowed its focus to matters of selection and classification rather than operational support. Not until Grow and Armstrong revived the hands-on aspects of aeromedical practice in the mid-1930s did physicians become actively involved in the growth of operational aviation. Their work at Wright Field, together with recommendations from the investigation board convened by General Arnold in 1939 to review the whole subject of flight surgeon support, sparked the renaissance of operational aviation medicine. The seeds

of the research of Grow and Armstrong were to bear more fruit during their collaboration at the Eighth Air Force's Central Medical Establishment in England. .

When World War II began in 1941, almost all of the physicians with World War I experience had left the service. Some 23 years had elapsed between the wars, and the American Air Forces had very few flight surgeons experienced in supporting operational flying units of any kind. Those few were senior colonels or general officers. The rest of the experienced mid-career flight surgeons on active duty when the war began had furnished only peacetime aeromedical support, mainly with training units. These flight surgeons now worked at headquarters level or at the School of Aviation Medicine.

Direct aeromedical services for operational units after the build-up of the armed forces that began in 1940 came mainly from physicians new to the service who held the rank of first lieutenant or captain. Although many had considerable civilian clinical experience, they served in combat without direct supervision from experienced flight surgeons. The wartime Air Surgeon, Major General David Grant, devoted considerable effort to keeping his far-flung corps of flight surgeons informed about the lessons being learned, and much of our basic aeromedical literature derives from his efforts.

Although the Berlin Airlift and the Korean War began three and five years respectively after the end of World War II, many of the lessons so hard-learned in that great conflict had been lost or forgotten during the rapid demobilization that followed its end. In addition, the USAF, separated from the Army in 1947, had acquired its own separate Medical Service only in 1949, a year before the Korean War began. This new Service had few experienced flight surgeons and even fewer experienced non-flight surgeon medical officers. Repeating the experiences of 1940, the onset of the Korean War in 1950 found most career physicians, whether flight surgeons or not, filling posts at higher headquarters or at medical centers. Only a few mid-career flight surgeons were available for assignment to combat operational bases during the first two years of the war. Cold War assignments in support of the strategic and tactical air forces involved in countering the Soviet threat in Europe and in the Far East required the full attention of many of this small group of physicians, with the remainder being assigned to Japan and Korea in support of the rapidly growing "hot" war.

Although many of the physicians who served in World War II came from medical school faculty positions, few flight surgeons who served in Korea were academicians, and therefore they made almost no contributions to the medical literature, a fact that became clear as the authors of this Technical Report researched that war. Although hundreds of flight surgeons had direct combat experience in World War II, the few veteran flight surgeons still on duty in the Air Force in 1950 did not systematically pass on the lessons they had learned to their successors who supported the Berlin Airlift and who served in Korea. This pattern repeated after the end of the Korean War in 1953 when flight surgeons who obtained first-hand combat experience in that conflict did not pass on their lessons to later flight surgeons.[96]

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[96] DRJ attended the basic seven-week flight surgeon course in 1960, seven years after the Korean War, and still has his notes. He received essentially no training in combat aviation medicine during his training at USAFSAM, even though several of his instructors had served in Korea. As RWM and DRJ researched the

The war in Vietnam was the fourth major United States conflict that involved the use of powered aircraft. Flight surgeon support to combat aviation units reached maturity in Southeast Asia. Had that conflict ended as quickly as the Korean War (i.e., in 1963 rather than in 1973), the Air Force would likely have again learned few enduring lessons about flight surgeon service with operational units in combat. As the USAF established itself in SEA, some bases received their sole initial aeromedical support from inexperienced "two-year" physicians, new to the service and novices in the practice of aviation medicine. However, the Vietnam War grew to involve all U.S. military services for over ten years. Within a year of the establishment of major bases in SEA, senior USAF medical officials began to assign graduate Residents in Aerospace Medicine—RAMs—as Directors of Base Medical Services (DBMS) as a matter of policy, a policy that continued until the end of the war. The very length of the war established a conduit of aeromedical education that endures to this day.

Every official and informal evaluation of these RAMs' services has concluded that they were equal to the task. No literature exists proposing, much less supporting, an opposite point of view that, as a group, medical officers other than RAMs could have done a better job. The RAMs' training in matters of public health, sanitation, preventive medicine and military medicine, in addition to aviation medicine, enabled them to serve in the multiple roles required of a DBMS as commanders of their medical units, wing staff officers, public health officers and mentors who supervised junior flight surgeons on the job. The admirable records of the RAM flight surgeons mentioned in this review stand as examples of aeromedical leadership.

Although the early RAMs serving in SEA had received little formal training in the practice of operational combat medicine on an air base, they quickly mastered the required skills. This Technical Report has illustrated the three policies that evolved to assure that their successors learned these skills before arriving in the combat theater.

First, flight surgeons in SEA had continuing communication with USAFSAM and its parent Aerospace Medical Division—the AMD—at Brooks AFB via staff assistance visits from the CONUS to SEA, as illustrated by Ellingson's visit to Bien Hoa early in the war and Warren's response to the need for better body armor. AMD and USAFSAM monitored the bi-monthly Aerospace Medicine Reports sent to the Air Force Surgeon General from each base, from the Seventh and Thirteenth Air Force Surgeons, and from the Pacific Air Force (PACAF) surgeon's office.

Second, RAMs already mentioned in this report—Chapman, Moser, Rayman, Davis, Hansen, DRJ and George Shafer— and others not mentioned—Roy DeHart, Richard Malone, William King, Richard Hancey and Clarence F. ("Fletch") Watson, for example—received assignments back to USAFSAM after their service in SEA. This policy maintained the flow of experience from the combat zone to the School during and after the war. The presence of course supervisors and teachers who had served recently and with distinction

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section of this Report on Korea, it became clear that the flight surgeons involved in that conflict had produced almost no literature or official reports to serve as lessons to their successors.

assured that newly trained flight surgeons (many of whom were Berry Plan draftees) and graduating RAMs received instruction from those whose experiences were fresh and valid. Further, these physicians recorded many of their observations and distributed them widely. The writings of Moser and Rayman exemplify these efforts.

Third, the selective assignment of newly-graduated RAMs to SEA, "Phase IV" of the residency, assured that the lessons learned and taught would be reapplied on the spot, and the rapport between School staff and operational flight surgeons would keep lines of communication open. This allowed for fine-tuning both the training in and the operational application of aeromedical principles. The present Technical Report has demonstrated the high quality of their performance there.

The faculty at USAFSAM systematically analyzed and recorded the lessons learned during the war in Vietnam, and the principles derived from that conflict remained in the curriculum at USAFSAM after the war. Similarly, Vietnam veterans continued to serve on the staff during the next 15 years or so. For these reasons, many of the precepts learned during that war entered the routine practice of aerospace medicine during the remaining years of the Cold War. These concepts became part of the long-term corporate memory of the flight surgeon profession, and entered into training curricula, regulations and technical documents. As the smaller conflicts of the 1980s began, flight surgeons once more put into practice the lessons concerning combat deployments and operations, and began to adapt them to the small, intense conflicts and operational deployments that occurred from 1980 to 1991. The series of operations in Grenada, Panama and Libya produced another generation of flight surgeons with first-hand experience in such matters. These men and women applied the lessons to the Gulf War and Serbian air campaigns, with the results that we have recorded. No missions failed or were cancelled and no aircraft were lost in these conflicts for medical reasons. Further, the rate of man-day losses from diseases and injuries among USAF fliers and non-fliers alike were the lowest in American military history.

Aviation and aerospace medicine have come a long way from their roots in World War I to this ultimate measure of success. As we have moved through the 20th century, we have seen the concept of the flight surgeon's role expand from its original duties of selection and health maintenance to a modern view of a physician involved in all aspects of Air Force combat support medicine—an operational doctor. As the missions change, flight surgeon roles change. Unmanned Aerial Vehicles (UAVs) such as the Predator and Global Hawk Dark Star now roam the skies. Their ground controllers—their "pilots, " termed Aerial Vehicle Operators (AVOs)—receive physical examinations and direct medical support and care from flight surgeons on the same basis as do all aircrew and air traffic controllers (Air Force Instruction 48-123, specifically Attachments 6 and 7).

USAF flight surgeons, by regulation rated and paid on the same basis as other aviators, are required to participate in regular and frequent aerial flights, to meet physical and training standards analogous to other aviators, and to be available at all times for world-wide service. This seems to be a uniquely American military concept. Although we have not attempted a systematic review of the subject, we are not aware of similarly broad flight surgeon roles in any other nations' air forces.

The flight surgeon role has attracted physicians with personality patterns somewhat similar to those of other aviators and somewhat different from physicians as a whole. Taken as a group, we have seen them as action-oriented, flexible, innovative, adaptable to the practice of their profession in extraordinary conditions, and at home both in operational and in medical settings. Today, many are residency-trained in primary medical specialties as well as in aerospace medicine. Because the Medical Corps of the past three decades has contained a higher proportion of career medical officers than during the first seventy years of the 20th century, today's flight surgeons are better trained in military matters and more experienced in deployment medicine than ever before.

Air Force medicine continues to evolve. Advances in deployment medicine parallel the modern emphasis on asymmetrical warfare. As the mission changes, we see a draw-down in personnel, along with the closure of many air bases. As American medical practice changes, we see a concomitant diminution of emphasis on traditional military hospital practice. As overseas missions develop, we see increased mobilization of Air National Guard and Air Force Reserve medical units and personnel. Evolution of the Air Force and its medical support in response to new threats to national security during the past few years has led to changes as great as those of the post-Vietnam era. Through it all, the records of yesterday and today clearly demonstrate that modern flight surgeons are building upon the lessons of the past, responding to the realities of the present and anticipating the challenges of the future. They support the Air Force mission as effectively now as did their predecessors throughout the last century.

Summary of Lessons Learned

In presenting the history of aeromedical care by operational flight surgeons to American combat fliers during some ninety years of air combat in diverse situations, we have emphasized the lessons learned about the value of that care. We have said little about the history of progress in the vital areas of life support systems and instrumentation—the presentation of situational information to aircrew members. Most other books on aeromedical history have emphasized such technical matters (viz., Armstrong, Noe, Robinson), or organizational concerns (viz., Benford, Peyton). Link & Coleman's account of World War II aviation medicine blends these elements with some of the human accomplishments, analyzing the record from a historical perspective. Not being physicians, they do not attempt a medical analysis. Because the technical and organizational aspects of aeromedical advances have been so thoroughly documented, our focus has been on operational support rather than technological support.

Each arena of aerial combat during the Twentieth Century differed from its predecessor and from its successor, but the lessons were much the same in all the wars. Perhaps the basic principle underlying these recurrent findings derives from the fact that, for all practical purposes, *human nature does not change.* Flying an aircraft in combat requires an unusually high degree of moment-to-moment skill, coordination and attention. Fliers, no matter how carefully selected, trained and equipped, are human, and humans in combat react to the

demands and circumstances of battle in predictable patterns. While initially adaptive, in time these stress-related reactions tend to degrade performance.

Perhaps one may fairly compare the need for aeromedical support to aviators with the need for maintenance of aircraft, for both flier and machine are necessary for effective flying and fighting, and both must be in top condition. Like aircraft, combat aircrews are expensive and limited resources that cannot be quickly replaced when they become disabled. *In order to maintain and prolong aircrew combat effectiveness, fliers require a degree of command sensitivity, personal aeromedical support and mental hygiene different from that required by other combat personnel.* This lesson, ignored by combatant air forces during World War I until the last stage of that conflict, has become so ingrained into international air command policies, aeromedical doctrine and practice as to be almost second nature.

Aeromedical support to combat aircrew members is preventive, therapeutic, and intensely interactive. Most American medical schools teach neither military medicine nor aerospace medicine, and physicians who are motivated to learn and practice these specialized arts as flight surgeons must learn them in the armed services.[97] The motivation of a physician to become a flight surgeon, which has rarely been discussed and never studied, generally includes a personal interest in aviation that one may fairly compare to the motivation of aviators for flying.

Aeromedical care is best given by flight surgeons assigned to specific flying units who are responsible to the unit commander as well as to a medical commander who will not preempt their aeromedical duties in favor of providing routine medical care. In plain words, flight surgeons seem to function most effectively with only broad supervision, so that they can care for their fliers and families as they see fit under the prevailing circumstances.

In peace or in war, all active duty USAF fliers operate in a constantly changing environment. The basic flying unit, the squadron, has personnel assigned for tours of from one to three years, a policy assuring continual turnover of everyone from the commander down to the newest officer and enlisted aircrew, as well as the flight surgeon. Unlike non-flying USAF members, fliers have historic role models and a strong, widely publicized tradition of their expected combat behavior. *One important purpose of historical records such as this Technical Report is to establish similar role and behavioral models for present and future flight surgeons.* Future flight surgeons must attend to maintaining a thoughtful and organized long-range historical record of flight surgeon activities, with periodic analysis of trends and prediction of future needs. Because military aerospace medicine is unlike other clinical specialties, no parallel system of civilian medical care can serve this purpose.

Squadrons also have some collective recent memory of personal experience in combat, though this varies between units and wanes quickly as younger fliers replace veterans. Flight surgeons practice their art in groups of two or three, if not alone, and so their collective memory, if available at all, rarely lasts more than a year. This fact contributed to

[97] As this was being prepared for publication, a brief note appeared about a "first of its kind" ten-week elective in aerospace medicine being offered at Midwestern University, Arizona College of Osteopathic Medicine (Barber, 2003).

the loss of "collective memory" about combat aeromedical practice after World Wars I and II and the Korean War, and will remain a possibility after every conflict. *The School of Aerospace Medicine has always played a major role in maintaining the continuity of operational aeromedical experience, and care must be taken that this chain of professional knowledge not be broken.* Advances in technology, tactics and strategy, as well as changes in the nature of warfare also tend to make previous combat experience less applicable to the next conflict. Experienced flight surgeons—and especially the small cadre of USAF pilot-physicians—have played an invaluable role in these matters, and in adapting new weapons systems to their human operators in the past. Studying flight surgeon performance in previous conflicts may help to identify enduring elements of aeromedical support to flying units engaged in combat operations, and future operational flight surgeons may find a written record of their colleagues' collective experiences useful in conflicts yet to come. To summarize the salient principles of combat aeromedical practice, we will review some recurrent themes that emerged from this historical review.

Adaptability and Innovation

Flight surgeons in combat have been characterized by their flexibility when confronted by the uncertainties and surprises of war. One may fairly compare the doctors' responsibility for readiness to cope with the unexpected challenges of war with their professional responsibility for maintaining medical readiness to deal with diseases and injuries at a moment's notice. Unforeseen circumstances may require extraordinary responses. For examples of innovation, one may point to Thomas White serving as a tailgunner in order to fly on the Doolittle raid and to his subsequent medical services to his fellow aviators after their crash landings on the China coast. Don Flickinger and his medics made their first parachute jumps into New Guinea to aid a group of aircraft crash survivors. Lowell Eddy taught his aircrew to reconstitute and administer blood plasma in flight. Bruce Warren flew on the missions that tested his newly developed body armor. Kress Lochridge learned to use the armament on rescue helicopters, and was able to participate in the defense of his patient and his crew. Another flight surgeon in Vietnam learned to scuba-dive at an underwater crash site not only in order to recover the bodies of crewmembers, but also to locate the elevator of the crashed aircraft. This led to identification of the cause of the crash, a flaw later found and corrected on three other aircraft in the same unit. We have seen many less dramatic but equally ingenious examples of improvisation in the sections on the Gulf War and the Balkan Air Campaigns.

The experience of the squadron-level flight surgeons in England during the raid on Libya demonstrates that all operational flight surgeons, regardless of their assignments, must remain able and ready to assume responsibility for support to combat operations at any time. Klaus Schafer and Peter Senechal improvised a schedule of "no-go and go pills" for the raid on Libya. During the Air War Over Serbia, Bruce Guerdan developed several unorthodox methods of maintaining the care of his flying unit under stringent and politically sensitive deployment conditions.

Flight surgeons must not only be willing and able to innovate and improvise under all conditions, but also to assure that the innovation does not interfere with or degrade other

operations, a military responsibility equivalent to that of any line officer. A flight surgeon should communicate such procedures along the appropriate medical chain of command, rather than concealing them. If possible, one should notify higher HQ that, "Unless otherwise instructed, I intend to..." followed by the reason for the deviation from standard practices. Even if exigencies of the moment do not allow for prior approval, such communication does make the actions and the reasons for them a matter of record for future consideration, and represents the physician's assumption of responsibility for his or her actions.

In ongoing conflicts abroad, aeromedical authorities may wish to establish in-theater aeromedical centers for teaching, consultation and operational research. Delegating broad waiver authority to such centers will increase combat effectiveness by shortening the time necessary for complex aeromedical decisions that exceed base-level flight surgeons capabilities, facilities or time. Such centers can also provide professional backup for mishap investigations, which otherwise require local involvement that will surely drain aeromedical resources away from primary mission support.

Medical Care in Foreign Countries

In many situations, flight surgeons may depend upon host country civilian or military medical facilities for inpatient or specialty medical care or consultation. At times flight surgeons may have to compromise their usual practices. Courtesy, diplomacy, and an understanding of local customs and expectations are invaluable assets in such situations. Coordination between U.S. military services may also serve to fill professional needs. Here, personal contacts between physicians—courtesy visits, admission privileges, exchanges of call roster responsibilities and other areas of mutual support—may ease the burden. With the smaller medical corps of today's armed forces, it is possible that some of the physicians will have trained or served together previously, and friendships formed during inter-service programs may have unexpected benefits in deployment situations.

Practicing medicine in combat arenas may involve one situation requiring specific comment. A request from a commander or a local official for a military physician to give medical aid to non-military persons, foreign nationals, and especially to refugees may present difficulties. Line commanders (and some flight surgeons) may not understand that the U.S. Code Title 10 specifies those who may receive care from USAF medical personnel, and only the Departments of Defense or the Air Force are authorized to grant exceptions allowing others to receive this care. The Code does not delegate any discretion to flight surgeons in this matter.

Flight Surgeons Joining a New Squadron

Traditional USAF combat deployments involve squadrons moving quickly from "home bases" to distant locations. Each squadron includes a unit-assigned flight surgeon and a small team of enlisted medical personnel. The assigned flight surgeon provides medical support to the fliers and usually to non-flying squadron members such as crew chiefs. Flight surgeons are generally the first Air Force medical personnel assigned to a new base, or to a

new unit arriving at a combat base. Many bases will receive several units, each with its own flight surgeon. At least one flight surgeon should be senior in rank and experienced in the basic principles of public health, sanitation, and occupational medicine.

Deploying flight surgeons should plan to be medically self-sufficient for at least a week after their arrival at a newly established combat base, and should carry the necessary supplies and equipment with them. Current line command policies delegate to local unit commanders the authority to approve flight surgeons to fly with their units as observers in combat operations, based on local conditions.

Deploying squadron flight surgeons and their medical technicians may accompany their home-base units on deployment; this is the "ideal" situation. However, in every war that we have examined in this report, many flight surgeons have joined their units at the combat site for the first time. This may happen under several circumstances that will probably recur in future conflicts.

Even experienced flight surgeons previously assigned to the receiving base are "new" to a unit deploying onto that base. "New" flight surgeons might also be deployed from other bases, or might be activated directly from the Air National Guard (ANG) or Air Force Reserve (AFRes) and assigned to the deploying flying units. Sometimes the flight surgeon and aeromedical technicians may be strangers to each other, the unit commander, the fliers, the aircraft, the mission, and to any other medical assets already in place. The flight surgeon may never have flown in this unit's aircraft, or even the class of aircraft (as when a transport squadron flight surgeon is attached to a fighter squadron), and may know nothing about unit personal equipment or mission profiles. If any aspect of the unit mission is classified, the flight surgeon may not have the proper security clearance to become familiar with it.

Prior planning at headquarters level may avoid most mismatches between flight surgeon and unit, but the pressures and rapid tactical changes of combat life make some such occurrences inevitable. Flight surgeons must maintain their individual flexibility, plan for unexpected contingencies, work with commanders to correct or waive requirements, and obtain necessary training on the spot as soon as possible.

No data exist about the length of time necessary for a flight surgeon to bond with a new unit, but an able and experienced flight surgeon can probably work comfortably into the job in about two weeks. An inexperienced flight surgeon will take longer because of having to learn about being a flight surgeon as well as about the unit. In such situations, mentoring by the senior flight surgeon on site or by staff assistance visits from higher headquarters medical supervisors is an invaluable aid to the process.

Flight surgeons should live in the same facilities as the aircrew of their primarily supported unit to facilitate familiarity and informal conversation and to maintain close observation of living conditions, sanitation, and general public health measures. Flight surgeons supporting several units should try to become equally well acquainted with members of all units.

Bruce Guerdan's observations and suggestions about the process of bonding in such situations, extensively discussed in the chapter on the Persian Gulf War and the Air War Over Serbia, illustrate how this may be done. His principles involve professional, social and flying activities, and may help the unit to regard the flight surgeon as "one of us." Above all, however, *the flight surgeon must be a good doctor; without this, nothing else matters.*

Circadian Factors and Fatigue

Modern air war involves long-range bomber missions flown from U.S. bases to distant targets. Circadian rhythm, aircrew rest intervals between flying such missions, and round-the-clock flight surgeon coverage remain issues that require operational consideration, and one may predict with some certainty that these issues will arise in future conflicts. A flight surgeon deployed to the field cannot possibly plan for all the possible combinations of factors in these situations, but should master the basic principles to consider when advising line commanders about the schedules of individual crews.

Theodore Lyster observed in 1918 that *rest* is a critical factor in aviator effectiveness. This is still true, especially in the early stages of a combat deployment when everyone is dealing with unaccustomed stresses and problems. Since air operations may continue around the clock, attention to temperature and noise control are essential to facilitate daytime sleeping. When indigenous housekeeping custodians provide daytime cleaning services in billeting facilities, their supervisors should assure that they work quietly.

Along with *rest*, the second basic principle of flight surgeon care is *personal influence.* The flight surgeon should have frequent contact with the fliers in order to maintain personal knowledge of how they are doing collectively and individually. Prophylactic measures include careful scheduling, crew rest discipline, combat naps, hallway consultations with fliers who appear fatigued, limited use of sedative and stimulant medications, and *requiring* pilots to spend time away from work. (Fliers in Vietnam referred to this concept as going OFE, "Off the Face of the Earth," for a short period.) Combat fliers should be relieved of all military responsibilities except those essential to the mission. Commanders should not assign aviators any "additional duties" (i.e., serving as Awards Officer, Bond Officer, or Re-enlistment Officer); such work should be the responsibility of non-flying administrative personnel. Combat fliers should not be obliged or expected to participate in educational programs or nice-to-have training, even if required by routine policy. Such matters can be waived for the duration of the combat assignment.

In combat operations lasting longer than six months, senior commanders should establish specified combat tours and rest and recreational programs.

Sedative and Stimulant Medications

The USAF has discussed the use or non-use of sedative and stimulant medications—"no-go and go pills"—in combat fliers for over fifty years. Policies have alternated between permission to use such medications—careful regulation and instruction of flight surgeons in their proper selection and administration—and blanket prohibition of their use. The past

alternation of USAF policies between permission and prohibition depends upon media sensationalism, congressional inquiries and the opinions of various line and medical officials. Cessation of instruction to new flight surgeons in the proper use of these medications naturally accompanies the prohibition of their use. One may expect such cycles to continue.

The lesson of history is that, without regard to media attention or perceived political correctness, in some circumstances it is more hazardous <u>not</u> to use "no-go and go pills" than it is to use them. Use of any medication in an aviator carries some concomitant risk. Balanced judgment between these two risks, the risk of flying while fatigued and the risk of using medications to counteract that fatigue, should be made by the three individuals at the scene who are most closely concerned and best informed: the commander, the flight surgeon, and the flier. Fliers who may be assigned to combat or combat support missions should be ground tested for their individual responses to such medications, and the results posted in their permanent medical records for future reference. If the commander and the flight surgeon agree that a planned mission will cause a degree of fatigue that is dangerous to aircrew safety or efficiency, then the flight surgeon should make the medications available to the fliers under carefully planned and briefed conditions. When the sleep period extends for 8-10 hours before the mission briefing, *each flier may decide for himself or herself* whether or not to take the sleeping medication. During the mission, *each flier may decide for himself or herself* whether and when to take the stimulant medication (one tablet, followed in four hours by a second if necessary to maintain alertness). Generally, the timing of this action is such that the flier will remain alert while landing. The flight surgeon should debrief the fliers after the mission and retrieve all unused medications in order to prevent any later unauthorized or unsupervised use.

Regardless of any current policy regarding use of sedative and stimulant medications, initial and recurrent training of military flight surgeons should include the philosophy and principles of use of these medications in fliers. All operational fliers should be informed about and ground-tested with the appropriate medications in quiet times, rather than under the press of operational mission planning. Aeromedical authorities should insure a continuing flow of professional information about ongoing research on this subject to active flight surgeons. Only in this manner can operational combat units remain prepared for the exigencies of fatiguing combat missions, no matter how unforeseen.

Flying and Fighting from Home Bases

In recent wars, some aircrews have flown combat missions from established bases where the fliers lived at home with their families. This may have occurred in a few locations in Japan early in the Korean War where aviators would, at least metaphorically, get up in the morning, kiss their wives and children goodbye, go out to fly combat or combat support missions over Korea, and return home that evening for supper and a good night's sleep before repeating the process.

Similarly, a few hearsay accounts have told of aviator's wives coming to Vietnam using routine passports and tourist visas, and living near their aviator husbands for part of the

combat tours. Again, no aeromedical analysis of the effects of such arrangements is available.

No one published aeromedical information about these family matters after the Korean War, and it was rarely discussed until the Balkan Air Campaigns. The history of USAF air combat since the Grenada campaign reveals an increasing emphasis on "fighting in place" from CONUS and from overseas bases, and one may fairly expect this process to continue for the aircrews of fighter-bombers, heavy bombers, refueling tankers, AWACs aircraft, transports and other operational airframes. Aeromedical support in such circumstances must extend beyond aircrew to their family members.

One of the bedrock principles of USAF aeromedical practice has been that flight surgeons should, whenever possible, provide basic medical services to their fliers' families. This has two immediate benefits. First, the availability of this personal service from a provider who knows about the effects of flying on their lives relieves the fliers and their spouses of one possible source of stress. Second, the flight surgeon remains privy to the family situations of unit fliers. This information may be useful concerning stressors that can affect mission accomplishment (worries about sick children, for example). Even if the flight surgeon is not the primary family physician, his/her availability to discuss medical problems being cared for by other providers allows for a possible flight surgeon role of medical "interpreter" or "advocate" that may be of value.

Those providing aeromedical and other support to families at Aviano and elsewhere during the AWOS provided better documentation than had been available in previous conflicts. The data demonstrate several useful principles:

1. FSs should be available to furnish primary care to the families of aircrew who wish to use this service. Many aircrew families use flight surgeons as their "family doctors" in peacetime, and this familiar source of care and counsel is even more supportive during combat operations.
2. If family members require consultation with medical specialists, flight surgeons can act as "medical advocates" for the families in the same way that they do for the fliers. Regardless of the locations involved, flight surgeons anywhere can assuage anxieties of fliers and their families by relaying medical information between family members at one location and fliers at another, or from flight surgeon to flight surgeon at the two locations involved. The knowledge that flight surgeons are caring for their families may relieve fliers of concern about the well being of their loved ones.
3. Commanders, chaplains, family service representatives, flight surgeons and aerospace psychologists can coordinate their activities in order to communicate accurate and non-contradictory information to families. These authorities can answer questions in a non-threatening and convenient setting. Subjects that can bolster family support for the fliers include education about proper eating habits, crew rest (changing shifts and long hours, circadian disruption) and stress reduction (little time together, irritability and fatigue when together, concerns for life and limb, decreased communication, and the sense of being overwhelmed by circumstances).

Until now, USAF experience with fighting in place has involved conflicts in which the Air Force sustained few aircraft losses. A "hot" war that causes continuing air combat casualties while family members live on or near the base may present flight surgeons with some new challenges. Peacetime fatal mishaps used to be more common, so that flying units and individual fliers had experience in dealing with loss of aircrews. However, today's commendable safety record implies less organizational memory of how to deal with such events from personal, group and family viewpoints in times of combat. A series of such losses is bad enough in a unit far from home, but in past wars fliers could suppress or deny their emotional effects, in essence "forgetting it," putting it behind them and getting on with the job. Presence of family members may prevent or delay this accustomed system of defenses. The authors have no authoritative data to offer about this subject from their research into this history, but suggest that it is a proper concern for flight surgeons and other family support agencies in planning for future conflicts.

The Role of the U.S. Air Force School of Aerospace Medicine

Selection of USAFSAM Faculty

This historical review has emphasized the role of USAFSAM in the selection and training of flight surgeons for duty in combat theaters. We have also pointed out the value of ongoing contact between flight surgeons in the field and flight surgeons at USAFSAM. This contact has taken the form of staff assistance visits and the interchange of assignments of individuals to the field and back to the School. Graduates of the Residency in Aerospace Medicine—the RAMs—who have obtained extensive field experience, including experience in combat operations, must continue to be assigned to USAFSAM, both to the teaching faculty and to the Aeromedical Consultation Service. Many of these senior flight surgeons also have considerable academic and didactic skills. Personal experience in combat operations does not last long in the military. Peacetime concerns sometimes eclipse wartime lessons and experiences. In order not to lose the lessons of combat aeromedical practice as they were after the two World Wars and Korea, those responsible for physician assignments must give priority to assuring that the faculty at USAFSAM maintains this corporate knowledge. Physicians attending the Primary Course in Aerospace Medicine and the Residency in Aerospace Medicine must learn their lessons from those who have "been there and done that," and must also learn how to analyze those lessons and apply them to situations that have never before existed.

USAFSAM and Medical Intelligence Data

The history of medicine offers many instances in which established medical authorities ignored, ridiculed or actively attacked breakthrough discoveries. A prime example was the opposition of Viennese physicians to the accurate observation of Semmelweiss that unwashed medical hands on obstetrical wards caused puerperal fever. Such an attitude about unexplained medical phenomena in modern battlefield settings could be lethal. As we have seen, the School has a long and honorable tradition of working with flight surgeons in the field to deal with new medical challenges to safe and efficient flight operations.

Medical intelligence is matter of two-way communication: the School cannot teach that which it does not know. Young operational flight surgeons have a responsibility that is as old as the practice of medicine: to recognize what is new and significant in operational settings. They must be alert to unknown or unexpected medical matters, and must be trained to pass items of medical intelligence rapidly up the chain of command to their colleagues in headquarters and to USAFSAM. Modern Air Force medicine calls for a "high index of suspicion" about novel medical situations, especially in a world where bioterrorism, chemical warfare and weapons of mass destruction are everyday concerns.

Experience has shown that within about ten years after "the last war" most of those who possess combat experience will have little everyday contact with their younger successors, either because of retirement or through promotion to positions of authority at distant headquarters. The command structure at the School must encourage analysis of combat experiences in order to avoid out-of-date interpretations of basic principles: rote teaching is not enough. *Aeromedical authorities must encourage and facilitate operational research by flight surgeons during times of combat support.* The aerospace arena has always maintained a rapid rate of change, and this will certainly continue to be true. Today's computers facilitate compilation of medical statistics and the writing of comprehensive "After-Action Reports." However, the durability of electronic information storage is still evolving. Conventional publication assures the enduring availability of lessons learned in combat. *Veteran flight surgeons must commit their combat experiences to peer-reviewed journals, technical reports and textbook chapters if the lessons they learned are not to be forgotten. Their successors must evaluate and re-interpret the problems and solutions of previous conflicts in order to avoid training the flight surgeons of the future to fight the wars of the past.* The motto of the United States Air Force School of Aerospace Medicine describes it best.

***Volanti subvenimus*: We support those who fly.**

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APPENDIX A

FLIGHT SURGEONS KILLED IN ACTION

WW I

None

WWII

1. 1Lt William R. Schick, USA, MC; Pearl Harbor; 7 Dec 1941
2. Capt. Charles A. Stafford, USA, MC; Java; 3 Mar 1942
3. Capt. George C. Wassell, USA, MC; British Isles; 24 Oct 1942
4. Capt. Joseph W. Mendoza, USA, MC; New Foundland; 2 Jan 1943
5. 1Lt Burton A. Hall, USA, MC; New Caledonia; 13 Jan 1943
6. Maj. John J. Meany, USA, MC; North Africa; 20 Mar 1943
7. 1Lt William C. Craig, USA, MC; Northern Ireland; 28 Apr 1944
8. Maj. Barney Lihn, USA, MC; France; 7 Jun 1944

Viet Nam

1. Capt. Robert L. Mann, USAF, MC; 22 Oct 1965
2. Capt. William P. Simmons, USAF, MC; 3 Sep 1966
3. Capt. Robert W. Fields, USAF, MC; 26 Mar 1969
4. Maj. Bobby M. Jones, USAF, MC; 28 Nov 1972

Persian Gulf War (Iraq)

1. Maj. Thomas F. Koritz, USAF, MC; 18 Jan 1991

This information is displayed on the plaque at the U.S. Air Force School of Aerospace Medicine, Building 175, 2601 Louis Bauer Drive, Brooks City-Base, Texas. The flight surgeon class that graduated on 20 December 1941 donated the plaque.

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APPENDIX B

FLIGHT SURGEONS KILLED IN AIRCRAFT MISHAPS

1. Maj. William R. Ream, USA, MC; 24 Aug 1918
2. Maj. Edward R. Napier, USA, MC; 15 Sep 1923
3. Capt. David W. Bedinger, USA, MC; 25 Nov 1924
4. Capt. Charles T. C. Buckner, USA, MC; 19 Feb 1927
5. Capt. Thomas H. Miller, USA, MC; 15 Feb 1928
6. Capt. Dalmar R. Blakley, USA, MC; 1930
7. Maj. Charles V. Hurt, USA, MC; 16 Jul 1931
8. Capt. Carloss J. Chamberlin, USANG, MC (New York Guard); 16 Jul 1931
9. Capt. Ernest G. Tillmanns, USAR, MC; 16 Jan 1932
10. Capt. Ray H. Skaggs, USA, MC; 28 Mar 1934
11. Capt. William P. Donovan, USANG, MC (Missouri Guard); 15 Mar 1936
12. 1Lt Frank J. Otis, USA, MC; Jan 1937
13. Maj. Guy H. Moates, USAR, MC; 1 Aug 1937
14. 1Lt James W. S. Stewart, USA, MC; 18 Nov 1938
15. 1Lt Hubert T. Elders, USA, MC; 18 Aug 1940
16. Lt. James C. Fleming, USN, MC; 4 Jan 1941
17. 1Lt John R. Brosheer, USAR, MC; 8 Jun 1941
18. Capt. William S. Hargan, USA, MC; 19 Jul 1941
19. Capt. Arthur LaRoe, USA, MC; 21 Jul 1942
20. Maj. Raymond C. Stiles, USA, MC; 1 Oct 1942
21. Capt. Samuel A. Barkoff, USA, MC; Jan 1943
22. Capt. Arthur P. Vandergrift, USA, MC; 27 Jan 1943
23. Capt. Charles A. Anderson, USA, MC; 7 Mar 1943
24. 1Lt Ralph H. Sullivan, USA, MC; 27 Mar 1943
25. Maj. James P. Citta, USAR, MC; 16 Apr 1943
26. LTC Dan B. Searcy, USA, MC; Jun 1943
27. Capt. John D. McBrearty, USAR, MC; 29 Jul 1943
28. Maj. Robert C. Quine, USAR, MC; 1 Aug 1943
29. Capt. Robert C. Badertscher, USA, MC; 18 Sep 1943
30. Capt. George H. Ketler, USAR, MC; 18 Sep 1943
31. Capt. John N. Carnes, USA, MC; 10 Dec 1943
32. Capt. Joseph L. Nocontini, USA, MC, FS; 12 Jan 1944
33. Maj. Nathan W. Hylan, USA, MC; 28 Jan 1944
34. Capt. Joshua Levitsky, USA, MC; 25 Apr 1944
35. Capt Lewis J. Geerlings, USAR, MC; 10 May 1944
36. Capt. Ralph M. Wyatt, USA, MC; 8 Jun 1944
37. Capt Orville D. Thatcher, USA, MC; 22 Jun 1944
38. Capt. Morton A. Cundiff, USAR, MC; 4 Jul 1944
39. Maj. Howard M. Scull, USA, MC; 4 Jul 1944

40. Capt. Gregory A. Skully, USAR, MC; 13 Jul 1944
41. Capt. Leslie B. Roberts, USA, MC; 3 Aug 1944
42. LTC Melbourne W. Boynton, USA, MC; 19 Aug 1944
43. Capt. Frank J. Fische, USA, MC; 21 Aug 1944
44. 1Lt Richard F. Halford, USAR, MC; 31 Aug 1944
45. Maj. Luther C. Heidger, USA, MC; 7 Sep 1944
46. Maj. Gordon H. Haggard, USA, MC; 7 Oct 1944
47. Maj. Herman M. Turk, USA, MC; 1945
48. LTC Howard E. Sellards, USAR, MC; Jan 1945
49. Maj. Francis R. Lawther, USA, MC; 20 Jan 1945
50. LTC Jack P. Scott, USA, MC; Mar 1945
51. Capt. Norman E. Zahrt, USA, MC; 25 Jul 1945
52. Capt. Tom L. Weber, USA, MC; Sep 1945
53. LTC Harold D. Parks, USAF, MC; 11 Oct 1947
54. Capt. Robert J. Hall, USAF, MC; 9 Dec 1947
55. LTC Albert D. Phillips, USAF, MC; 9 Dec 1947
56. 1Lt Albert C. Kinney, Jr., USAFR, MC; 27 Dec 1947
57. LTC Sarkis D. Sarkissian, USAF, MC; 1 Nov 1948
58. LTC William Calaway, USAF, MC; Dec 1948
59. Col. Ehrling L. Berquist, USAF, MC; 13 Feb 1949
60. Capt. Altus B. Sansom, USAF, MC; 27 Mar 1949
61. 1Lt William C. Moskosky, USAF, MC; 14 Nov 1952
62. Capt. Joseph J. Engelbreit, USAF, MC; 21 May 1953
63. 1Lt Kenneth P. Mayo, USAF, MC; 18 Jun 1953
64. 1Lt Richard A. Rhamy, USAFR, MC; 1 Jul 1953
65. Maj. Henry E. Collins, USAF, MC; 5 Aug 1953
66. Capt. Adam G. Meister, Jr., USAF, MC; 17 Nov 1953
67. Maj. Gerald A. Orken, USAF, MC; 17 Dec 1953
68. Capt. William C. Loushin, USAF, MC; 31 May 1954
69. LTC Joyce A. Albert, USAF, MC; 28 Jul 1954
70. Lt Walter C. Dehm, USAF, MC; 24 Oct 1954
71. Capt. David C. Jacobs, USAF, MC; 24 Sep 1956
72. Capt. William E. Neuberger, USAF, MC; 21 Dec 1956
73. Capt. Frank F. Harradine, USAF, MC; 18 Dec 1957
74. Capt. James M. Thayer, USAF, MC; 15 Feb 1958
75. Capt. Ernest B. Swanson, USAF, MC; 14 Jul 1958
76. Col. Harry G. Moseley, USAF, MC; 10 Feb 1959
77. Maj. Frank W. Chandler, USAF, MC; 29 Aug 1959
78. Capt. Gene C. Beiers, USAF, MC; 18 Sep 1961
79. Maj. Julian E. Ward, USAF, MC; 13 Aug 1962
80. Capt. James T. Moore, USAF, MC; 7 Dec 1962
81. Capt. Robert A. Jutras, USAF, MC; 10 Apr 1963
82. Capt. William C. McCord, USAF, MC; 7 May 1963
83. Capt. Glenn D. Hoag, USAF, MC; 6 Aug 1963
84. Capt. Avery A. Crosby, USAF, MC; 28 Dec 1964
85. Capt. Joseph H. Trickey, Jr., USAF, MC; 26 Nov 1966

86. Capt. James R. McDougall, USAF, MC; 9 Aug 1968
87. Maj. Philip E. Donley, USAF, MC; 18 Jan 1971
88. Maj. Lindell Entzminger, USAF, MC; 18 Feb 1976
89. Col. William H. Walter III, USAF, MC; 6 Dec 1977
90. LTC John P. Allen, USAFANG, MC (Illinois); 25 Mar 1988
91. Col. Marvin A. Evens, USAFR, MC; 11 Apr 1992
92. Maj. Robert D. Verdone, 18 Feb 1993

This information is displayed on the plaque at the U.S. Air Force School of Aerospace Medicine, Building 175, 2601 Louis Bauer Drive, Brooks City-Base, Texas. The flight surgeon class that graduated on 20 December 1941 donated the plaque.

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ABBREVIATIONS AND ACRONYMS

24/7	Twenty-four hours a day, seven days a week; never ceasing
AB	Air Base
ACAM	Advanced Course in Aviation (or Aerospace) Medicine
AD	Air Division; Active Duty
AEF	American (or Allied) Expeditionary Force; Aeromedical Evacuation Facility
AEG	Aeromedical Evacuation Group
AES	Aeromedical Evacuation Squadron
AF	Air Force
AFB	Air Force Base
AFFOR	Air Force Forward (Command)
AFI	Air Force Instruction (Regulation)
AGO	Adjutant General's Office
AIC	Air Instruction Center
AID	Agency for International Development
AMD	Aerospace Medicine Division
AMO	Aviation Medical Officer
ANG	Air National Guard (sometimes preceded by state initials)
Anti-g suit	Anti-gravitational force suit, also called "g-suit"
AsMA	Aerospace Medical Association
ARRS	Aerospace Rescue and Recovery Service
ASEM	Aviation, Space and Environmental Medicine (journal)
ATC	Air Transportable Clinic
ATD	Air Transportable Dispensary
ATH	Air Transportable Hospital
AWACS	Airborne Warning and Control System (aircraft)
AWOS	Air War Over Serbia
BEE	Bioenvironmental Engineer
BBC	British Broadcasting Corporation
BSC	Biomedical Service Corps
CAP	Combat Air Patrol; Civic Action Program
CBI	China-Burma-India (WW II theater of war)
CENTAF	Central Air Force
CENTCOM	Central Command
CFS	Chief Flight Surgeon
CME	Central Medical Establishment
CONUS	Continental United States
CSF	Casualty Staging Flight
DBMS	Director of Base Medical Services
DMZ	Demilitarized Zone
DOD	Department of Defense

DRJ	David R. Jones (author)
EWO	Electronics Warfare Officer
FAC	Forward Air Controller
FEAF	Far East Air Force
FMO	Flight Medical Officer
FN	Flight Nurse
FS	Flight Surgeon
g-suit	Anti-gravitational force suit, also called "anti-g suit"
GMO	General Medical Officer
Go pill	stimulant medication, usually dextroamphetamine
HQ	Headquarters
ID	Identification (as in "ID card" or "ID tag")
JAG	Judge Advocate General
JHRC	Joint Homecoming Reception Center
JFACC	Joint Forces Air Component Command
JTF	Joint Task Force
JTFACC	Joint Task Force Air Component Command
KIA	Killed in Action
LORAN	Long Range Navigation (radar)
MAAG	Military Assistance and Advisory Group
MAC	Military Airlift Command
MAES	Military Aeromedical (or "Air") Evacuation Squadron
MASH	Mobile Army Surgical Hospital
MATS	Military Air Transport Service
MC	Medical Corps
MEDCAP	Medical Civic Action Program
MEND	Medical Education for National Defense
MRC	Medical Reserve Corps
MSC	Medical Service Corps
NAMI	Naval Aviation Medicine Institute
NASA	National Aviation and Space Agency
NATO	North Atlantic Treaty Organization
NCO	Non-Commissioned Officer; a sergeant or petty officer
NKP	Nakhon Phanom Royal Thai Air Force Base
No-go pill	Any sedative medication
OFE	Off the Face of the Earth; unavailable for duty
OJT	On-the-Job Training
OLC	Oak Leaf Cluster
PACAF	Pacific Air Forces
PAM	Preventive and Aerospace Medicine
PCAM	Primary Course in Aerospace Medicine
PCS	Permanent Change of Station
PDR	Physicians Desk Reference, a medication listing
Phase IV	Slang term for an assignment to Vietnam following the third year [Phase III] of the Residency in Aerospace Medicine
PJ	Helicopter Pararescueman, possibly from "parachute jumper"

POW or PW	Prisoner of War
Psywar	Psychological warfare
RAM	Resident [or Residency] in Aerospace Medicine; commonly used both during training and after it is complete
RAMC	Royal Army Medical Corps (British)
RFC	Royal Flying Corps (British)
RWM	Royden W. Marsh (author)
RPW	Repatriated Prisoner of War
R&R	Rest and Recreation
RTAFB	Royal Thai Air Force Base
RVN	Republic of Vietnam
SAC	Strategic Air Command
SAM	Surface to air missile; also School of Aerospace Medicine
SAR	Search and Rescue
SEA	Southeast Asia
SCUBA	Self-Contained Underwater Breathing Apparatus
SFS	Senior Flight Surgeon
SME	Squadron Medical Element
SWA	Southwest Asia
TAC	Tactical Air Command
TDY	Temporary Duty
TFS	Tactical Fighter Squadron
TFW	Tactical Fighter Wing
TRS	Tactical Reconnaissance Squadron
TRW	Tactical Reconnaissance Wing
UAV	Unmanned Airborne Vehicle
UK	United Kingdom
USA	United States of America; United States Army
USAF	United States Air Force
USAFE	U.S. Air Force, Europe
USAFHRC	U.S. Air Force Historical Research Center
USAFSAM	U.S. Air Force School of Aerospace (originally "Aviation") Medicine
USSR	Union of Soviet Socialist Republics
UVO	Unmanned Vehicle Operator
VIP	Very Important Person; a dignitary
WSO	Weapons Systems Operator
WW I	World War One
WW II	World War Two

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ABOUT THE AUTHORS

David R. Jones, M.D., M.P.H. retired from the U.S. Air Force Medical Corps in 1984 in the rank of colonel. Dr. Jones is a former USAF flight surgeon-psychiatrist with combat experience in Vietnam. He is a long-time member of the History and Archives Committee of the Aerospace Medical Association and former editor (1987-96) of the journal of that Association, *Aviation, Space and Environmental Medicine*. He is currently a private consultant in aerospace psychiatry.

Royden W. Marsh, M.D. retired from the U.S. Air Force Medical Corps in 1990 in the rank of colonel. Dr. Marsh is a former USAF pilot and flight surgeon-psychiatrist in the USAF and NASA. He supervises flight surgeon instruction and aerospace medicine residency training in mental health and clinical/operational psychiatry at the USAF School of Aerospace Medicine. He is currently the Chief, Neuropsychiatry Branch, Aeromedical Consultation Service at USAFSAM.

Drs. Jones and Marsh have published articles individually and in collaboration on aeromedical and military psychiatric topics since 1977, mainly in medical journals. The authors have also taught several aeromedical courses for some twenty years for the Air Force. They have presented elements of the subject matter of this Technical Report at the U.S. Air Force School of Aerospace Medicine, the U.S. Air Force Air University at Maxwell Air Force Base, Alabama, the Joint Armed Services Combat Casualty Care Course at Camp Bullis, Texas, and the Uniformed Services University of Health Sciences at Bethesda, Maryland,, as well as at various medical meetings.

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